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Eleven conference papers treat designing learning modules, or complete instructional facilities, for the deaf. The following aspects are considered: the changing classroom, a multimedia approach to teaching American History, a project design for a special school, and educational implications of architecture for the deaf. Further topics are acoustical design of classrooms for the deaf, the use of amplification in educating deaf children, furnishings in the workshop classroom, and lighting in the learning module. Creating environments for learning, providing through architecture for social needs, and planning the deaf child's complete formal education are also discussed; a report from Captioned Films for the Deaf, conference and discussion summaries, foreward, and introduction are provided. Appended are the program and roster of participants. (JD)

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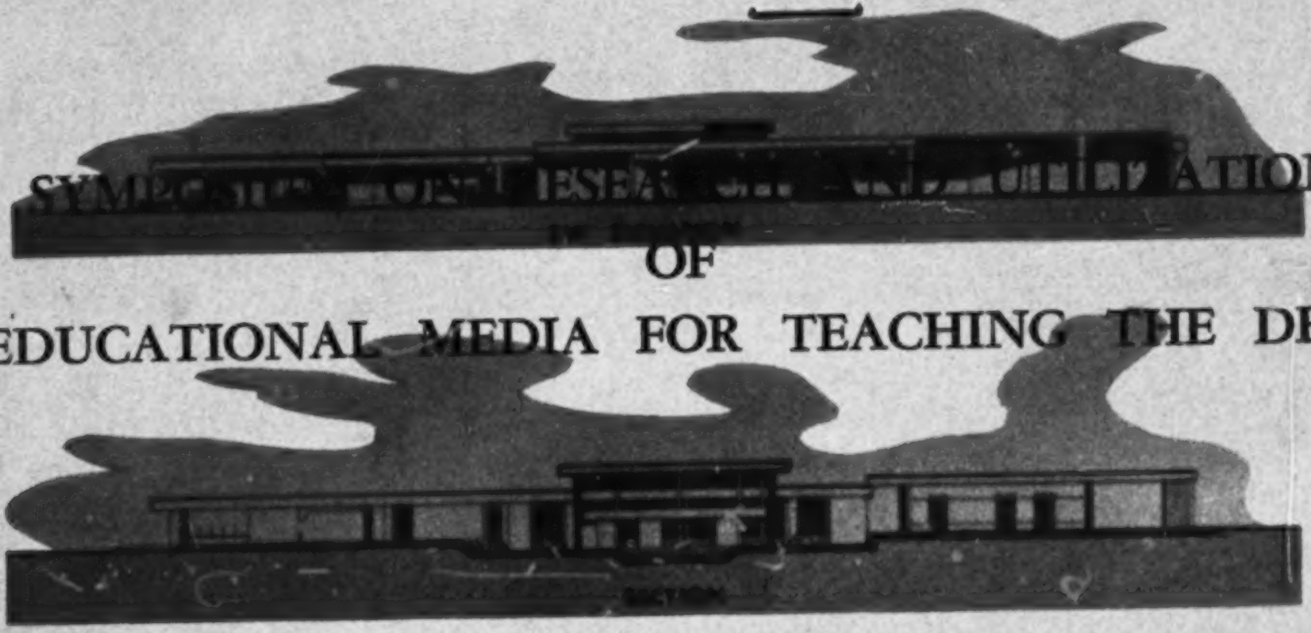
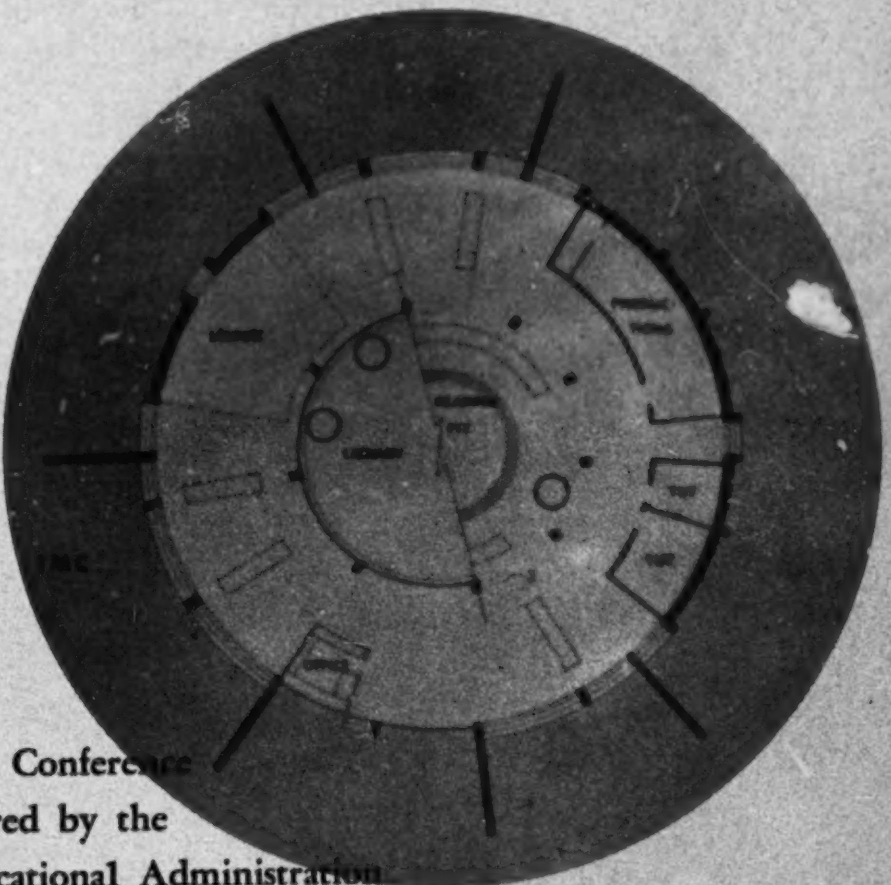
SYMPOSIUM ON RESEARCH AND UTILIZATION OF EDUCATIONAL MEDIA FOR TEACHING THE DEAF



"Designing Instructional Facilities for Teaching the Deaf: The Learning Module"



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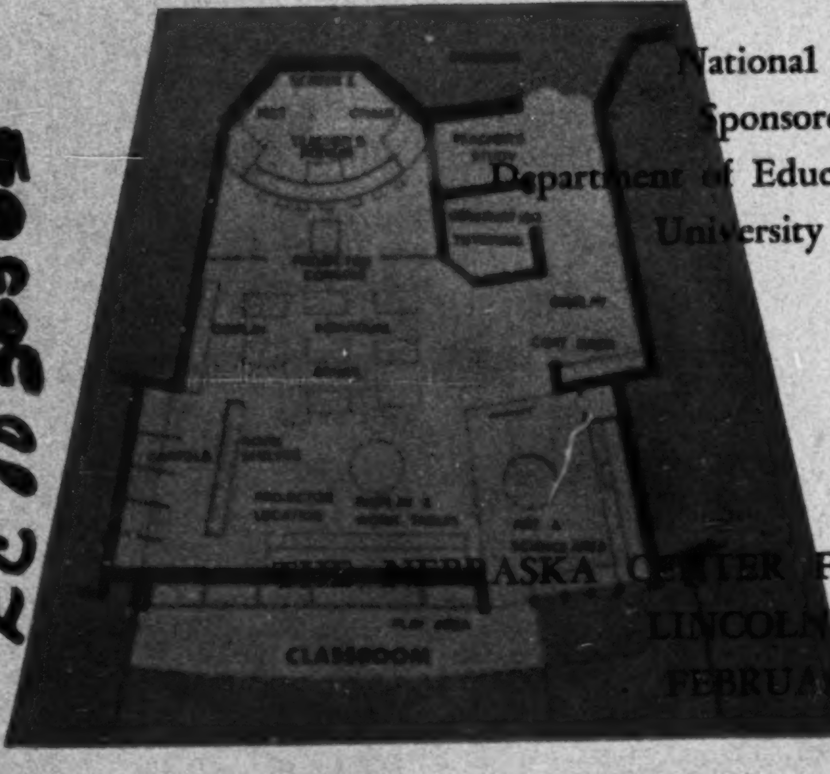

LECTURE AREA

THE NEBRASKA CENTER FOR CONTINUING EDUCATION
LINCOLN, NEBRASKA
FEBRUARY 5-7, 1968

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Symposium on Research and Utilization of Educational Media for Teaching the Deaf

"Designing Instructional Facilities for Teaching the Deaf: The Learning Module"

National Conference
Sponsored By The

University of Nebraska
Department of Educational Administration
Teachers College

and

MIDWEST REGIONAL MEDIA CENTER FOR THE DEAF

Support for this conference has been provided by a grant from Captioned Films for the Deaf, Bureau of Education for the Handicapped, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

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Robert E. Stepp, PH.D., Director of the Midwest Regional Media Center for the Deaf, is Professor in Educational Administration, Teachers College, University of Nebraska. This Center, one of four in the United States, was established in September 1966 at the University of Nebraska by Captioned Films for the Deaf, Bureau of Education for the Handicapped, U.S. Office of Education, Department of Health, Education and Welfare. The staff at the Center designs and produces instructional materials for use in teaching deaf students. This symposium is one of the activities administered by the Center.

Dr. Stepp has conducted research in utilization of 8mm sound films to teach speechreading to deaf children. Articles describing this research may be found in the March 1966 issue of Audiovisual Instruction and the June 1966 issue of Volta Review.

Dr. Stepp has been active in both state and national audiovisual organizations. He has been a member of the Board of Directors of the Department of Audiovisual Instruction, N.E.A., a member of its executive committee and on the editorial board of Audiovisual Instruction. He is currently on the National Advisory Committee to the 14 Regional Instructional Materials Centers for Special Education, under the Bureau of Education for the Handicapped. Dr. Stepp is listed in the National Register of the Educational Researchers published by Phi Delta Kappa.

Dr. Stepp has an A.B. degree from Central College (Missouri); a M.A. from the State University of Iowa, and his Ph.D. from the University of Nebraska.

FOREWORD

The fourth Symposium on Research and Utilization of Educational Media for Teaching the Deaf was held at the Nebraska Center for Continuing Education, University of Nebraska, Lincoln, Nebraska, February 5-7, 1968. This national conference was sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Media Services and Captioned Films*, Division of Services, Bureau of Education for the Handicapped, U. S. Office of Education, Department of Health, Education and Welfare. The general theme this year was "Designing Instructional Facilities for Teaching the Deaf: The Learning Module."

This was a timely topic because many schools for the deaf are in various stages of planning and constructing new facilities. In years past, schools for the deaf have tended to follow the national architectural designs of new construction developed for the public schools. For some reason, the unique learning problems and procedures for educating the deaf student haven't been reflected in building plans, space flexibility, furniture arrangement, and overall functional design. More often than not, the space is assigned, then adapted to teaching the deaf. Auxillary services, such as cafeteria, kitchen, and heating control room, are usually more functionally planned than the classroom. Maybe the term "classroom" is restricting our thinking. The subtitle of this conference, "The Learning Module," may suggest that the facility should be designed to provide an environment for learning, including all essential resources, equipment, and personnel. The inference here is that the space should be planned for the learner--not the teacher; and that the instructional activities that occur here should be student-centered exercises and not teacher-oriented functions.

* Formerly Captioned Films for the Deaf. Changed February, 1968.

What shape should this facility take? How large should each room be? What are the acoustical requirements? What type of amplification system should you use? How do you eliminate extraneous noise? What type of lighting should be installed in the learning module? What is an acceptable illumination standard? What are the room requirements for promoting the appropriate learning experiences associated with each subject? The speakers at this conference did not give specific answers to all these questions, but they did cause the participants to think and reflect on these problems.

Keynote addresses were presented by Mr. Bertram Berenson, Hampton Institute and Council for Exceptional Children; and Mr. George Agron, Research and Programming Department, Stone, Marraccini and Patterson, San Francisco. Discussion papers were prepared and presented by Mr. Richard Clouser, Pennsylvania School for the Deaf; Mr. Richard Meisegeier and Mr. Raymond P. Stevens, Gallaudet College; Dr. Arthur F. Niemoeller, Central Institute for the Deaf; Dr. Ira J. Hirsh, Central Institute for the Deaf; Dr. Allan Leitman, Early Childhood Education Study, Education Development Center, Newton, Massachusetts; and Dr. Donald Perrin, University of Southern California. In addition, we heard a special report from Dr. John Gough, Media Services and Captioned Films, on the activities of that agency. Mr. Peter Owsley, Chairman of the First Session, opened the conference with a succinctly stated overview of the importance of this three day meeting. The success of this conference rests with the outstanding contributions of each of these speakers.

Thanks and appreciation are also extended to the other Chairmen of the several Sessions: Dr. Stanley Roth, Mr. Gilbert Delgado, Dr. William McClure, Mr. George Propp, Dr. Wesley C. Meierhenry, and Dr. Powrie V. Doctor. Special mention should be made of the contributions of the efficient conference staff: Mr. Norman O. Anderson, Dr. C. Joseph Giangreco, Mr. Floyd McDowell, Mr. John

G. Nace, and Dr. John Wiley, Recorders; Mr. George Propp, Symposium Editor, Dr. Marshall Hester, Dr. William Jackson, and Dr. Ray Wyman, Resource Consultants; Miss Janet Bourne and Mr. Robert K. Lennan, Interpreters; Mr. Ken Stevens, Conference Coordinator, and Mrs. Marcia Carlson, Secretary.

A unique feature of the symposium was a display of building plans of elementary schools for the deaf designed by seniors in the School of Architecture, University of Nebraska. This project, under the direction of Professor Homer Puderbaugh, was the fall semester assignment for these college students. The designs were most creative and the exhibit which resulted made a significant contribution to the conference. The names of the senior students may be found at the close of the roster.

Special recognition should go to Dr. John Gough and Mr. Gilbert Delgado in the Washington office of Media Services and Captioned Films, for their wise counsel and support. The conference staff and participants are most grateful to Media Services and Captioned Films for providing the grant which made the symposium possible. More than one hundred and sixty educators of the deaf and architects took advantage of this meeting by participating in the conference.

The addresses and discussion papers are reproduced in the order that they were presented at the conference. The schedule of activities is printed in Appendix A. A roster of the participants may be found in Appendix B. The report of this conference, as was true for the 1965, 1966, and 1967 Symposia, will appear in the November issue of the American Annals of the Deaf. The Midwest Regional Media Center for the Deaf, University of Nebraska, and Media Services and Captioned Films, U.S. Office of Education are indebted to the American Annals of the Deaf for devoting one issue of their journal to this symposium report.

Dr. Robert E. Stepp, Director

Peter J. Owsley was born in Wisconsin. He received his B.S. degree from the University of Wisconsin-Milwaukee in the Education of the Deaf in 1949, and his M.S. degree in Audiology and Speech Correction from Northwestern University in 1950. He is presently completing a doctorate in Educational Administration at Temple University.

From 1950 to 1961 he served as teaching-principal, Oshkosh School for the Deaf, Oshkosh, Wisconsin. In 1961 he joined the staff of the Pennsylvania School School for the Deaf as Assistant Headmaster and Director of Education, and he holds a joint appointment as Associate Professor of Special Education at the Pennsylvania State University where he coordinates the teacher training program at the Pennsylvania School for the Deaf.

In July, 1968 he will become Director, the Davison School, Atlanta, Georgia. He visited schools for the deaf, clinics, and universities in Western Europe for thirty days in January and February, 1966, and attended the Fifth Congress of the World Federation of the Deaf in Warsaw, Poland, in August, 1967.

INTRODUCTION

by

Mr. Peter J. Owsley
Assistant Headmaster
Pennsylvania School for the Deaf
Associate Professor
Pennsylvania State University

It gives me a great deal of pleasure to open this year's Symposium dealing with "Designing Instructional Facilities for Teaching the Deaf: The Learning Module," inasmuch as this has been a subject of great personal interest to me for the past three years.

It is my understanding that the participants in this Symposium include administrators of schools for the deaf, as well as architects. My assignment is to demonstrate the importance of this Symposium to the education of the deaf and, at the same time, develop a common meeting ground for educators and architects so our discussions can be meaningful. I humbly hope that my brief remarks will set the stage for a successful and profitable three days. I leave the specifics to the eminently qualified speakers who follow.

School buildings for normal hearing children are considered a teaching instrumentality that will determine, to a large degree, the capability of an educational program to operate effectively. The design of a school building must be determined by the program requirements, pupil and staff needs, and community aspirations of those associated with it. It is the responsibility of the architect to propose a design that clearly interprets the requirements the educational plans have provided, and it is the joint responsibility of the educational planners and the architect to evaluate the proposed design to see that it meets the established objectives. Herrick[1] points out that a school building should be designed to fit the activities that are to take place within it.

> "A school building designed without proper educational planning can merit high praise for its aesthetic qualities, its economy of construction and ease of maintenance, and other features not closely related to function, but only by chance can it be equally deserving of praise for its contribution to a good school program over a period of years. Careful and thorough educational planning, as well as good architectural planning, is essential if the completed structure is to be a helpful tool, rather than a hindrance to the many generations of teachers and pupils who will use it."

Sound educational planning of the school plant is especially important if the school building is to be used to educate hearing-impaired children. The educational program for hearing-impaired children must be carried out in a suitable environment in which due consideration has been given to the special programmatic needs of hearing-impaired children. Only with an appreciation of the hearing-impaired child's special programmatic needs -- speechreading, auditory training, language and speech -- can we determine what special environmental planning in school building construction is necessary to meet their special programmatic needs.

Sensory deprivation limits the world of experience of the hearing-impaired child, and he is forced to rely more heavily on his other close sense, which is vision. For this reason, the hearing-impaired child is visually oriented, and vision will be his primary avenue for learning. Although hearing-impaired children are primarily visually oriented, most of them do have some residual hearing. It is important that educational planners of school buildings in which hearing-impaired children will be learning take this shift into consideration and make every effort to provide an adequate visual and auditory environment.

Over the long history of education of hearing-impaired children, educators have been most interested in the development of techniques of teaching speech, speechreading, auditory training, language, reading, and other school subjects, and the literature has been largely devoted to these subjects. They have been greatly concerned with the special programmatic needs of hearing-impaired children, but have not been so concerned with special environmental planning in school building construction to meet these needs. A review of the literature shows few references to school plant planning per se.

A few educators of hearing-impaired children have recognized the importance of special environmental planning in school building construction. This concern, however, has been restricted to audition and the acoustic conditions in classrooms in which hearing aids are used. Watson[2] reports that aids cannot be expected to give maximum help where the acoustic conditions under which they are used are poor, and that it seems to be part of the function of a school to provide the best possible environment in which learning can take place. Hudgins[3] points out that "the training must be carried out in a suitable environment; that is, in a room in which reverberation is reduced to a minimum, and where external and internal room noises are muffled or eliminated." According to Streng[4], "it seems folly to invest thousands of dollars in hearing aid equipment without providing an environment in which it can be used effectively." Little, if any, reference is made in the educational literature of the deaf to the need for a proper visual environment. The gap between what is known and recommended in terms of visual and auditory environmental planning, and what one sees in present day school buildings in schools for the deaf, is indeed a wide one.

The results of a questionnaire sent out earlier this winter regarding present practices in school building construction in schools and classes for hearing-impaired children, demonstrates that most school buildings have been patterned after school buildings designed for normal hearing children with little, if any, consideration for the special programmatic needs of hearing-impaired children. It is encouraging to note that some schools have taken into consideration the special programmatic needs of hearing-impaired children in the planning and construction of school buildings, and it is hoped that one of the outcomes of this three-day Symposium will be an increased interest in environmental planning in schools for the deaf.

The task of building a school has never been an easy one, and the task facing today's educators and architects is perhaps more complex now than it has ever been before. It is not easy to provide effectively for the boundless enthusiasm of children. There is no single blueprint to the provision of channels for the curiosity of the young and growing mind. There is no simple way to provide a multi-programmed curriculum to meet the needs of all hearing-impaired children. But this is a beckoning challenge and not an insurmountable one. New materials and equipment, new insights and know-how, and new methods and techniques are available to today's planner. Physical facilities must reflect this challenge. Broad and rapid changes are occurring in our time; the potential for change in the future promises to exceed that of the present. The people of the country look to education as the key to life in a free democratic society. The home of education is the school. To plan for it, to design it, to build it, and to make it function effectively is a challenge and an opportunity to the school administrator, the teacher, the architect, and all who plan schools for tomorrow.

We, as educators of the hearing impaired, have a choice. You might say we are at the crossroads. We can continue to build school buildings as we have in the past -- more egg crates, so to speak -- or we can look toward the future and plan and build schools that reflect our ambitions, hopes, aspirations, and dreams for the youngsters entrusted to our care. In this way we can strive to help hearing-impaired children move forward and upward to a way of life that is better, fuller, richer, and more rewarding than that which they have now.

I look forward to the day when educators and architects working together can point with pride to school buildings and have them recognized, as many schools are in general education, as "The Profile of a Significant School".

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THE CHANGING CLASSROOM

by

Mr. Richard A. Clouser
Educational Consultant
Pennsylvania School for the Deaf
Philadelphia, Pennsylvania

Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

Richard A. Clouser is a classroom teacher at the Pennsylvania School for the Deaf. During the 1966-67 academic year he served as Educational Consultant on an Educational Facilities Laboratories grant. In this capacity he traveled throughout much of the United States and western Europe to study innovative aspects of plant development in schools for the deaf. This study led to a work entitled "New Frontiers in Learning and Living for the Deaf Through New Age Facilities" which will be published soon.

Mr. Clouser received the B.S. degree in Education from West Chester State College, the M.A. degree in History from Temple University, and another M.A. in the Education of the Deaf from Columbia University. He served an administrative internship at the Lexington School for the Deaf during 1965-66. In September of 1968 Mr. Clouser will enter Pennsylvania State University to begin work on the Ph.D. in Audiology.

THE CHANGING CLASSROOM

It is not too difficult to find examples of early Twentieth Century school buildings for hearing-impaired children in our country, and so a comparison of those schools with what is being built today is easy. With few exceptions, the earlier schools for the deaf exhibited little difference from schools for children with normal hearing. They simply were a place to teach deaf children.

Today, educators of the deaf are realizing more and more the tremendous effect a properly designed school building can have on the educational process. There is much more thought going into the planning of a building in this age than in any other, and with fruitful results. The sensory shift in a hearing-impaired child is being taken advantage of by the influx of media and provisions for the use of media; and the acoustical properties of classrooms have been improved significantly over the past five years. But, however noteworthy these advancements are, it would be poor judgement to be satisfied with stopping at these accomplishments.

The deaf child today and in the future faces a much greater challenge than ever before in history. He has won his rights, to be sure, and does not face the ostracism of several hundred years ago. However, the problem referred to here is not a social one, but an educational one. Today's deaf child must be prepared to compete in a world of ever-increasing affluence and sophistication. In many of our normal high schools across the country this sophistication is exemplified by students using computers to work out homework problems, by a group working out an advanced problem in economics in a "think tank", and even by the average student in many high schools using a dial-access system for more information on a particular topic. Realizing this, our problem is not just one of trying to improve the education of the deaf, but the much more difficult one of trying to maintain or close the educational retardation gap between the hearing and the deaf child.

It is axiomatic that not all hearing-impaired children are capable of advanced academic work; however, it is just as true that they all should be given the opportunity to reach their highest level of attainment. Many ingredients are necessary to accomplish this goal--one being the school building, which should be designed to provide the student with the facilities best suited to his individual needs. More specifically, the learning areas (or classrooms) must meet the demand placed upon them by new learning theories, new methods of instruction, and new material. Hence the need for "The Changing Classroom".

Basic Consideration

There are many things which are both common and essential elements to a well designed classroom. Among these are proper temperature and humidity control, adequate lighting, and sound control. These items are interrelated and, therefore, considered together. Taking into consideration the differences in climate across the country, it is reasonably safe to say that whatever temperature is desired, the system should not need to rely on open windows for fresh air, because such openings destroy the acoustical properties of a classroom. In areas with warm summers it is even more important to have a closed system with air conditioning provided, since the possibility of a year-round school session may some day become a reality.

The most advantageous system of climate control would be one in which each classroom could be regulated individually by the teacher. Climate control should include the control of humidity. This is an important consideration in schools which are carpeted, since the discomfort of shocks due to static electricity is usually high in a heated building with low humidity.

The acoustical properties of classrooms should be carefully worked out on a basis of noise entering from the outside as well as sound generated within the classroom itself. Usually the noise outside the classroom is broken down into two areas--noise outside the building and noise inside the building. Classrooms vary considerably, and so the acoustical treatment of classrooms varies. But, in many European schools an average reverberation time of .5 seconds @ 1000 Hz is accepted, and walls and windows are made to afford approximately 45 db of attenuation. In addition, it has been recommended that, "The level of noise that should be permitted to enter a classroom should not exceed 30 decibels."[1]

Lighting is considered in this group because it may be possible to use the heat from the luminaries as the primary source of heat for the building. This type of system has been used very successfully in many buildings and would have the added advantage of decreasing the noise likely to enter a classroom from a conventional heating system.

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[1] A.W.G. Ewing (ed.), Educational Guidance and the Deaf Child (Manchester: University of Manchester, 1957) p. 178.

It must also be remembered that in some cases fluorescent lighting causes interference with electronic equipment and/or may be the source of a rather unpleasant "hum". Both of these objections can be overcome, but at an increase in cost of the installation. Regardless of what type lighting is used, higher levels than what is employed in ordinary schools should be considered for use in schools for the deaf. Since the light bulb was invented the accepted candle power in classrooms has steadily risen. This, plus the importance of vision to a deaf child, may lead us to a significant increase in years to come. This should be anticipated and planned for.

It would seem that the trend in many new schools for hearing students is to make the learning situation something to be enjoyed rather than endured. This trend should be carried over into the schools we build for hearing-impaired children. The color of the room, of course, plays a vital role in this respect, but is only the beginning. Many schools have turned to carpeting to help solve acoustical problems, and have reported better behavior which is directly attributable to the warm feeling the carpet gives. The furniture used in the classroom should be comfortable and easy to sit in for a long period of time. The amount of window space also deserves attention while considering items that make learning easier. Windowless schools are becoming more and more popular in our country among educators who realize the benefits afforded by them. Research into the effects of windowless classrooms on teachers and students has demonstrated a marked preference for them.[2]

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[2] James Augustus Chambers, "A Study of Attitudes and Feelings Toward Windowless Classrooms" (unpublished Ed.D. dissertation, Dept. of Education, Administration, University of Tennessee, 1963).

In our situation, it would seem that for older hearing-impaired children the advantages would greatly outweigh the disadvantages. The one big advantage is that hearing-impaired students, far from being given a greater disability in a windowless room, would probably be better students, since distraction from the outside would be non-existent. This is a critical problem, as every teacher of the deaf knows. Other benefits are:

a. Better sound control

b. Decreased cost of building

c. More display area in the classroom

d. Less affect of outside weather on child's performance

e. Better control of heat and cooling systems

f. Elimination of glare

g. Uniform and more easily controlled light

h. More building flexibility

The major objection, although unproven, is the psychological feeling of isolation. It is for this reason that a windowless classroom is not recommended for younger hearing-impaired students.

Classroom Types

In a school which includes all ages of deaf children, the classrooms can be roughly divided into three groups--ages one through six, ages seven through eleven, and age twelve through graduation.

The first division is characterized by the word space. Space for activities such as creative art work, rough play, general play, structured learning, and informal learning is mandatory. The structured learning area can again be broken into two areas. The first is where the children are seated in the traditional semicircle around the teacher and facilities for displaying media. The second is an area where programmed learning takes place. This can be done with basic teaching machines, cartridge films, filmstrips, etc. Both of these areas should be fully carpeted.

Ideally, this classroom should have a large outside play area adjacent to it. Part of the outside play area should have a roof to shield it from the elements. An additional advantage would be the use of astro-turf, or some other polypropylene indoor-outdoor carpet, under the roof to prevent injuries to the children.

All of the furniture should naturally be scaled down to the children's height. Shelves for books and games can easily be used to separate the different areas. These should be just high enough to prevent the students from looking over, not the teachers. The chalkboards should be made so the children as well as the teacher can reach them. This could probably best be done by making them slide vertically. All the window sills should be low enough for the children to see out easily.[3]

The final recommendation for this age group is really one which holds true for all classrooms, regardless of the child's age, and that concerns amplification. There are three basic types of amplification systems being used in schools for hearing impaired children: (1) Induction loop, (2) Radio frequency, and (3) Hard wire. In many schools in Europe, two systems are used in one classroom. If the children are playing or engaged in a non-desk activity, the induction loop or r.f. system is used; but when the child is at his desk facing the teacher, he uses the hard wire system. This dual amplification system for classrooms should become standard practice in new schools.

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[3] Raymond Wyman, "Teacher Reaction to the Features Affecting Instruction in New Elementary Classrooms" (unpublished Ed.D. dissertation, School of Education, Boston University, 1956), p. 25.

The second division for students from age seven to age eleven will not have as many demands placed upon it as the first area, because the children are older and more sophisticated. It can be approximately half the size of the first division, but it still should contain areas for different kinds of activities. One part of the room may contain apparatus for elementary science experiments. Another part could be a reading area, and still another may have study carrels for use with programmed materials. Both this division and the one for younger children should have a large section of washable vinyl covering portions of the wall, and heated floors controllable by the teacher.

Our last division, for students age twelve to graduation, presents a different kind of problem. Since most classes at this level are on a rotating basis, each room becomes a special case, with no two the same.

Traditionally, many science rooms have had divided areas, or at least dual-purpose areas. That is, an area where the student could take notes from a lecture or perform an experiment himself. It seems logical, in the light of contemporary educational philosophy, to extend the idea which leads to the dual-purpose science room to all other classrooms. A typical result might be a social studies classroom which has a formal learning area where the students sit in semicircular fashion around a teacher who is equipped with the appropriate facilities for the display of media, but which also has another area where there are one or two carrels for individual study; provisions for map making, including a sink; charts, graphs, and maps; and provisions enough for the students to make everything from a model of a Greek City State to a modern irrigation system. The same concept of classroom planning can and should be carried into every body of knowledge at this level.

Learning Areas Common to All Classrooms

It may seem at this point that nothing revolutionary has been presented. That is probably true, since the suggestions are merely an extension of the current thinking in learning theory and the education of the deaf. The major difference between these ideas and what we have done in the past is that now the building must aid the teacher in providing for individual differences among students. Each area discussed has provisions for learning through formal instruction. An overwhelming percentage of learning still takes place with the teacher at the front of the class. This situation, no doubt, has been made much more attractive by the use of media. In the future, if the software catches up with the hardware, remote controlled media display systems may become commonplace. In such an event, the teacher in front of the class becomes much better armed than he is today. But, whether this takes place or not, the teacher always has another area to which he can turn, an area designed for the student to learn by creating on his own, by experimenting with different ideas, by searching out the concepts relating to a particular subject, to do on his own those things which the teacher had previously done for him.

There is yet a third area of learning designed into the classrooms at each level, and that is the area for learning through programmed material or, simply, for learning by independent study. The area should not be planned for use with computers (the case for a computer console in a classroom would be hard to establish), but anything else from programmed readers or hand-turned devices to automatic teaching machines should be included. This type of activity is most easily provided for by the use of carrels. There need not be one for each student, since it is anticipated that the teacher will have students in all areas of the room at the same time. The teacher's role, then, becomes expanded to include the directing of a variety of activities available in the classroom, each geared specifically to the needs of the students at a particular time or over a long period of time. For the teacher the key word in the classroom is flexibility--flexibility to conduct a vast variety of activities, or to adapt to a new approach which enables greater learning to take place. If we do not have this flexibility, our teachers are stifled and we cannot use their talents efficiently, the result being that our students suffer.

Flexibility

If we look back ten years and try to realize the changes that have taken place in the world from then until now, we are staggered by the new developments. Business and Industry could not exist today without computers. Many schools and colleges throughout the land use sophisticated electronic equipment commonly in the course of every day. This is not to say that in the next ten years the education of the deaf will be done by computer. It is merely attempting to demonstrate that within ten years it is extremely difficult to predict exactly what the education of hearing-impaired students will look like.

In this respect, we face many of the same problems confronting those planning schools for hearing children. Additional variables are added to our situation when considering the role medical science plays in determining our population. Because of these factors, we must design the schools of today to include as many new facilities as possible, and at the same time we must design the classroom so it can change to meet new needs.

There are four basic ways to achieve flexibility in a building: (1) Make it expandable, (2) Provide for change in relative demand, (3) Provide for future services, and (4) Allow for convertibility.[4] Numbers one and three are self-explanatory. How to "provide for change in relative demand" and "allow for convertibility" (two and four above) are more difficult questions to answer. By way of definition, "relative demand" is the load placed on a particular area of the school at a particular time. "Convertibility" is the ability of the structure to adapt to a changing need. Both of these items are directly related to the classroom.

It is easy to say that interior walls should be made movable or demountable, but it is difficult to determine the amount of wall space that should fall into this category. A pre-building survey should include a projection of the percent of anticipated change in specific areas. In a survey made over a period of at least three years for example it may be determined that the area of the school with the younger children appears to have more cause for change than that area of the school with the oldest children. Perhaps the area with the younger children could be designed to have a predetermined number of movable or demountable walls, thus accommodating the percent of anticipated change.

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[4] John Haro, "Flexibility: Can it Stave off Building Obsolescence?", College & University Business, Vol. XLII, No. 6 (June, 1967), p. 52.

The above is just one way of accounting for change that may be necessary in classrooms. The actual materials and procedures used present a different problem. One unique answer to this is found in the School Construction Systems Development Project, which was started at Stanford University in 1962 by Educational Facilities Laboratories. The project was originally meant to supply California schools with inexpensive answers to their problems of flexibility by means of developing integrated building components. The concept was so successful that its role has been expanded to include schools outside of California.[5] There are four manufacturers contributing to the program, one each for the main structure, the ventilating system, demountable interior walls, and folding interior walls.

For our purposes the SCSD concept is not without problems, perhaps the biggest being in regard to sound control. The attenuation afforded by most movable or folding walls is somewhat less than desirable. This is particularly true in the low frequency range where it is most needed for deaf children.

Regardless of how flexibility is achieved or what system is used to achieve it, the key appears to be in (1) making as few items as possible permanent fixtures in a classroom, and (2) planning for as much standardization of equipment as possible. Items under number one would include tables, chairs, and bookcases. A media module could be used to house all necessary projection equipment needed in a classroom (as well as lessen much of the noise from such equipment) and still retain mobility.[6] Auditory training equipment, all media facilities, and teachers' desks are but a few of the things which could be listed under number two.

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[5] For more information, please see, "Barrington Middle School: A Report 1966," (Barrington Middle School, Barrington, Illinois).

Classroom flexibility can be greatly enhanced by using the concepts of standardization and semi-permanent fixtures as discussed above. If combined with walls that can be changed, we can plan for a new school today and have it be just as contemporary fifteen years hence.

Conclusion

A case has been presented for the classroom of today and ways to accommodate the classroom of tomorrow. Our responsibility at the present requires us to look squarely at the problem of improvement in the education of hearing-impaired children. Are we satisfied with what we are accomplishing now, or can we improve? If we are not satisfied, then we must ask still another question--What role will school facilities play in the improvement of the educational process? Since this should be a recurring question, we may get different answers from year to year. To generate change for the sake of change is a mistake. To reject the new and unusual because it is new and unusual is just as big a mistake.

The single most important feature of a school building today is the classroom, but we must realize that it may very well not be the most important part in years to come. If we, for example, adopt a policy of integration in regard to hearing-impaired students, the whole structure of the school could change.[7]

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[6] Educational Facilities with New Media (Washington, D.C.: Department of Audiovisual Instruction, National Education Association, 1966), p. B-26.

The time for action is now if we are to be assured of laying the best possible ground work for the education of hearing-impaired children in the future.

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[7] See D.M.C. Dale's book, Deaf Children at Home and at School (Springfield: Charles C. Thomas, 1967).

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THE HISTORY OF AMERICA--A MULTI-MEDIA APPROACH

by

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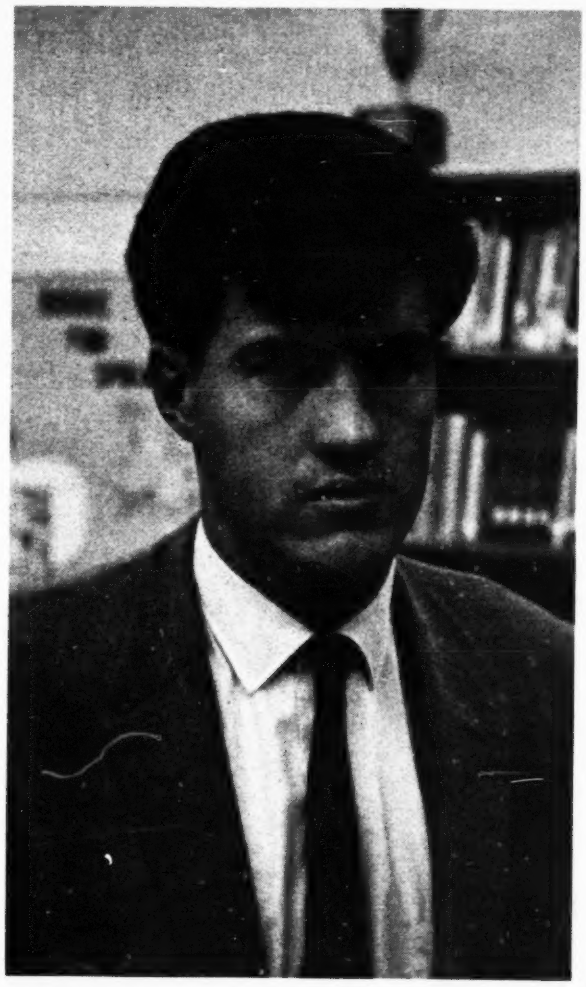
Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.



Richard W. Meisegeier earned the B.A. degree from St. Olaf College in Northfield, Minnesota. Following his graduation from St. Olaf, Mr. Meisegeier spent an academic year working with the deaf in St. Andrews and Dundee Scotland while attending the University of St. Andrews.

From 1963 to 1965 he served as Assistant to the Principal and Head Supervisor of the Kendall School for the Deaf. He then earned the M.A. degree in Teaching at Gallaudet College. He was then appointed the Gallaudet College staff as an Instructor in Education at the Kendall School. He is presently Curriculum Coordinator for Social Studies Development at the Kendall School.

Raymond P. Stevens graduated from Augustana College in 1964. He majored in history and minored in deaf education and psychology. In 1964-65 he was a high school social studies teacher of the deaf in the Minneapolis Public School System. While there he was selected as contributing-participant for the Governor's Committee on the Education of the Deaf in Minnesota.

He then attended the Graduate School at Gallaudet College from 1965 to 1967. In the summer of 1967 he became a member of the faculty of Gallaudet College where he is presently an Instructor of Education at Kendall School.

THE HISTORY OF AMERICA--A MULTI-MEDIA APPROACH

The project you are about to see demonstrated is the result of some five months of research and writing. The objective of our research was the development of a course in American History for the non-college bound deaf student. Although this objective does not preclude its use in a class of college-bound students, the emphasis has been to reach those students who, because of a language deficiency too great to read standard textbooks in American History, are too many times left without either books or classes in the history of their nation.

Regardless of the place this course would take in the over-all curriculum of a school for deaf students, the "Project," as we have come to call it, has what we consider to be three distinctive features. First, the approach to the academic study of history itself has been noticeably altered. The second is the fact that it was designed as a multi-media approach to teaching history, and the third is the fact that the materials are either teacher produced or have been secured by classroom teachers.

In order to place the Project in proper context for you today, it seems appropriate to briefly summarize the history of its development and to elaborate upon the above distinctive features. A final comment will be made concerning our personal philosophy of teaching American History to elementary and high school students.

While graduate students at Gallaudet College majoring in Social Studies, we did our student teaching at Kendall School under the direction of Dr. Thomas R. Behrens. We were at once dissatisfied with the standard materials in American History. We consequently set about trying to re-write some of the textbooks to meet the language needs of our students. While we were at least partially successful in meeting these needs, we were still dissatisfied with the historical content being taught. The political-military history traditionally taught as American History did not seem to meet the needs of the non-college bound students we had in mind. Memorizing who was which President of the United States and when, and what military battles occurred during his administration was not going to give these students the understanding and appreication of their heritage which they deserved.

This brings us to what we consider the first distinctive feature of the Project, its approach to the academic study of history. The emphasis is on the social-cultural changes in America. What was life like in America in 1619? When a child went to school in 1780, what was school? What did he study? What did he wear? What did the school look like? And when he went home after school, what did he do and what was his home like? In short, what was America like from a social-cultural viewpoint at various times in our history. When the average American thinks of the '30's, he recalls what life was like during the Depression, not the political and economical factors which lead up to and brought on the depression. When he recalls the World Wars, he does not envision detailed and complicated military stratagems, but rather what effect these wars had on his day-to-day existence. Are names and dates and places really all that important in understanding the growth of America? With but few exceptions, we decided they were not and set about writing our own history text.

This is where the next stage in the development of our Project came in. We decided to reverse the present trend in textbook layout. Rather than having one or two pictures to illustrate several hundred words, we decided to collect hundreds of slides to illustrate as few words as possible. Pictures could say what words could never say. It was at this point that we took our idea to Dr. Behrens. He immediately supported our efforts by making some money available for materials we felt we needed.

But in trying to write a textbook _per se_, we again found language our greatest obstacle. Sentences became stiff and artificial. It was at this point that the idea of letter forms came to us. Why not teach social-cultural history through letters? Better yet, why not have these letters written as if they had been written by teenagers and pre-teenagers describing life about them during the various periods of our nation's history! To help us in establishing a style or sentence pattern for these letters, we had some 60 students in the Washington, D. C., public schools write letters telling a friend or relative about Washington. The sentence length and syntax we used was based upon these samples. By the way, none of them wrote a word about the political atmosphere of Washington except for one or two who stated the President happened to live there.

By now the multi-media approach to teaching history, the second distinctive feature of the Project, was becoming a reality. We had each letter mimeographed and bound into booklets. Each letter was also reproduced as an overhead transparency. A capsule sheet preceded each letter--this was to pin point the main idea of the letter which followed. Armed with a 35mm camera we headed for the Prints and Photographs Division of the Library of Congress with its more than three million prints and photographs! After hundreds of hours of pouring over this material, we photographed and had made into slides some five hundred shots. These slides were supplemented with commercially prepared slides from such places as Plymouth Plantation and the Smithsonian Institution. We further supplemented our visuals with charts, maps, and copies of old newspapers obtained through FREE AND INEXPENSIVE MATERIALS and by making a number of our own overhead transparencies in our media center. Additional filmstrips and captioned films were integrated into the Project. Eight millimeter film-clips are also used at various times in the Project.

The fact that all the materials used in this project have been teacher produced or secured, the third distinctive feature of the project, emphasizes what we in the profession can do if we have the time and money--primarily the time. No one knows better than the classroom teacher what he needs for effective classroom teaching. Teachers must be given adequate time to produce the materials needed to teach our hearing-impaired youngsters. Administrators and teachers will have to work out a schedule whereby several hours each week can be set aside for this purpose.

In conclusion, I would like to make a final comment concerning our personal philosophy of teaching American History. Let me emphasize that all that has been said and that will be said concerns hearing students as well as the hearing-impaired. We do not care to be labeled as prescriptive historians for the deaf.

When one examines the social studies curriculum of our schools today, he generally finds that American History is taught twice, usually in the 8th and 11th grades. The only difference between what is offered in the 8th grade and in the 11th grade is simply that more of the same thing is taught in the 11th grade. It is our contention that this is a mistake. We object to the traditional political-military history in the early years of a student's educational life for two reasons. In the first place, by teaching political history twice we neglect the social-cultural aspect of our heritage. Political history is a general picture of our ideals as a political institution. Through this history we can see the changes both in the function and the role of our government and in the ways we have sought to maintain ourselves as a nation both on the national and international fronts. Without a doubt, our students should be educated in the political history of their nation. They must understand the changes our government has made, but they must understand more.

This brings us to our second objection to the teaching of political history in the earlier years. Thirteen year old students are interested in clothes, cars, and each other -- why should they not learn about their historical counterparts! Why is it that we tend to ignore the people of our nation in their own history? Why not first study the lives of the people who made America what it is today and then study the political ideals that these people followed. Again, consider the ages of our 8th and 9th grade students -- 12, 13, 14 -- how many of these students are really concerned about voting, the draft, and about the interpretation of our nation's constitution? How many of them can really understand the implications of the New Deal when none of them are allowed to work? Why not concern them more with how their counterparts of fifty, a hundred, or two hundred years ago lived? Why not teach them history as they themselves experience history? By this, I mean the average youngster is first interested in his social-cultural life. Then, when the responsibilities of young adulthood are thrust upon him, he becomes interested in or at least aware of the political, military, and economic factors in the daily life of our nation. If we present history in the same sequence in which he experiences it, history becomes meaningful to him. For after all, to understand history is to know how you would have endured had you lived during that time.

The project you are about to see demonstrated has been developed toward that end. Thank you.

DEMONSTRATION

Following Mr. Meisegeier's paper, a demonstration was given by his colleague, Mr. Raymond Stevens of the Kendall School faculty. The purpose of the demonstration was to give the Symposium participants some idea as to the classroom needs where the teacher emphasizes multi-media instruction.

Mr. Steven's demonstration was with the 5-6 grade class of the Prescott Hard-of-Hearing Unit in Lincoln. Equipment used was two overhead projectors, a Kodak Carousel, and three screens. The reason for two overheads was that one was used for projecting the letterform and the other was used for projecting visuals. This reduced the amount of manipulation and switching and kept the verbal material on the screen all the time. Other units of the series would employ the 16mm projector filmstrip projectors and various other hardware.

The general procedures utilized in the demonstration are sufficiently described in Mr. Meisegeier's paper. The particular unit demonstrated related to the development of the West.

The fact that he had to work in make-shift surroundings under pressure of severe time limitations and with a class with whom he was not familiar put Mr. Stevens under a considerable disadvantage. However, the demonstration did impress the participants with the necessity of designing classroom facilities in which media needs are an integral part. The demonstration also underscored the point that a great deal of visual material is available to the history teacher who has the time to search and organize.

PROJECT DESIGN

by

Mr. Don Voss

Mr. Ross Iverson

Mr. Neil Clark

University of Nebraska
Lincoln, Nebraska

Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

RECOGNITION PAGE TO ARCHITECT STUDENTS

Mr. Neil B. Clark

Mr. Richard A. Davis

Mr. D. R. Fitzsimmons

Mr. R. E. Iverson

Mr. Norval Jones

Mr. Martell A. Jorgensen

Mr. N. E. Kolder

Mr. David J. Meyer

Mr. Kenneth Miller

Mr. S. J. Petersen

Mr. Robert F. Seeger

Mr. Richard Swain

Mr. Don Voss

Mr. Ivan Virtiska

Mr. Steven Yaussi

Mr. Homer Puderbaugh, Instructor

PROJECT DESIGN

Don Voss
Ross Iverson
Neil Clark

Good afternoon, ladies and gentlemen. This is Neil Clark and Ross Iverson. I'm Don Voss. We are students of the fourth-year Design Class here at the University of Nebraska. We would like to present our architectural problem study of deaf education. I'll start off with the recognition and definition of the problem as it was presented to us; then Mr. Iverson will continue with the group approach to the problem; and Mr. Clark will conclude with an individual solution of the problem.

Now, I'll explain the recognition and definition of the problem. Dr. Stepp and Mr. Propp introduced the educational problems of the hearing-impaired child to us. That problem is to compensate for their communication and experience deficiency. Dr. Stepp and Mr. Propp accentuated that an educational opportunity equal to that of normally endowed children necessitates the following two things: One, classroom specially designed and equipped to facilitate the use of auditory training units, visual materials, and modern educational media. Two, provision for broadening experience backgrounds of deaf students, both real and simulated. This would include movies, TV, live dramas, field trips, etc.

They furnished us with a very realistic background by guiding us through three schools for the deaf. We began with the Prescott School here in Lincoln, then went to Omaha to visit the Omaha Hearing School and the Nebraska School for the Deaf. With this introduction to deaf education, our class decided the problem necessitated design of special classrooms and IMC areas. These were the accentuated areas. The most practical way to approach this, we decided, with the help of Mr. Propp and Dr. Stepp, was to design an elementary school for the Lincoln area. In specifics, the problem then was narrowed down to accentuation on individual study areas and group study areas with a limitation of 1 to 8 teacher-student ratio in each classroom.

We then had to select a site in Lincoln. In doing that, we had to have some basis or criterion for selecting it and that evolved into two points. We wanted to give the deaf child a cross-section of experiences not all urban and not all rural; and, also, we wanted to place them adjacent to a normal school to provide two things: possible interaction with normal classes and, automatically, it would provide such things as cafeteria facilities, thus freeing us to concentrate on the design of classrooms and IMC areas for we would have the food catered or else we would assign this service to the school. We selected three areas that fitted these qualifications. They were Maude Rousseau, East Ridge, and Holmes Elementary here in Lincoln. On the basis of the criterion that I have just given you, we selected Holmes. Now that we have recognized and defined the problem, Mr. Iverson will explain how as a group, our class, approach the problem. Mr. Iverson:

After an investigation of the basic essentials of the problem involving the various means of exposure as discussed by Mr. Voss, the class began the process of interpreting these needs in a facility for educating the deaf. I've divided a basic description of this process into three general areas: first, is the collection of pertinent data; second, is the design, interpretion, and analysis; and finally, the synthesis process.

The collection of data was divided into six areas of which various groups of the class were assigned. These included visual aids, an area in which we did extensive study into the various equipment that would be required in the facility along with their physical shapes and sizes. Another consideration was acoustics in which we explored some of the various acoustical materials available to us and the various amplifications system which would be required in a school for the deaf. Color was another area in which we did some study as to the functional and aesthetic applications this would have in the school. Lighting was another area we studied, trying to discover some of the special considerations that would be needed in this school because of the visual communication required in a school for the deaf. Another area was scale. This is concerned with the relationship of the student to the facility. Some of the items we included in this were furniture, ceiling heights, widths of rooms, and also the eye level between the student and the teacher. The last area of study, but not least, was the curriculum. In this we did some study into the present trends of the educational system and some of the projected trends of what education may be like in years to come. This was done to keep our facility flexible enough to accomodate these changing educational needs. This data was collected, not only for the requirements of a typical educational facility, but with an eye towards the special considerations that the deaf require. Data in these various areas was compiled and made available to each member of the class in the form of charts and diagrams.

From this material and the previously suggested program of Dr. Stepp, the second phase of our process began, that of design, interpretation, and analysis. This phase very basically involved taking this information and establishing a list of activities that would take place in this facility and trying to determine the various circulation patterns that would take place to, from, and within these various activities. As noted by Mr. Voss, more extensive studies were done in the areas of the classroom and the IMC.

The last process was simply one of synthesis in which all these various elements were brought together with the aid of various architectural programming devices. We tried to accommodate both the functional solution from the standpoint of educational needs and the architectural solution from the standpoint of aesthetics. I don't mean to divide the two. We believe they work hand-in-hand. I would like to turn the last portion of the presentation over to Mr. Clark who will present his end-product of the various efforts I have described to you. Thank you.

Mr. Clark:

I, now, would like to present my solution with a series of slides. If you will bear with me, I will put on a hand mike and get a pointer, and we'll go through the slides.

On this first slide (Figure 1) I'd like to show you the basic organization I used to develop the activity spaces within the school. I've divided the activities that take place within a school into seven distinct areas. The seven areas then developed into a schematic floor plan. The lower level (lower right of Figure 1) is divided into two spaces, both being for informal student activities. First (E) is an

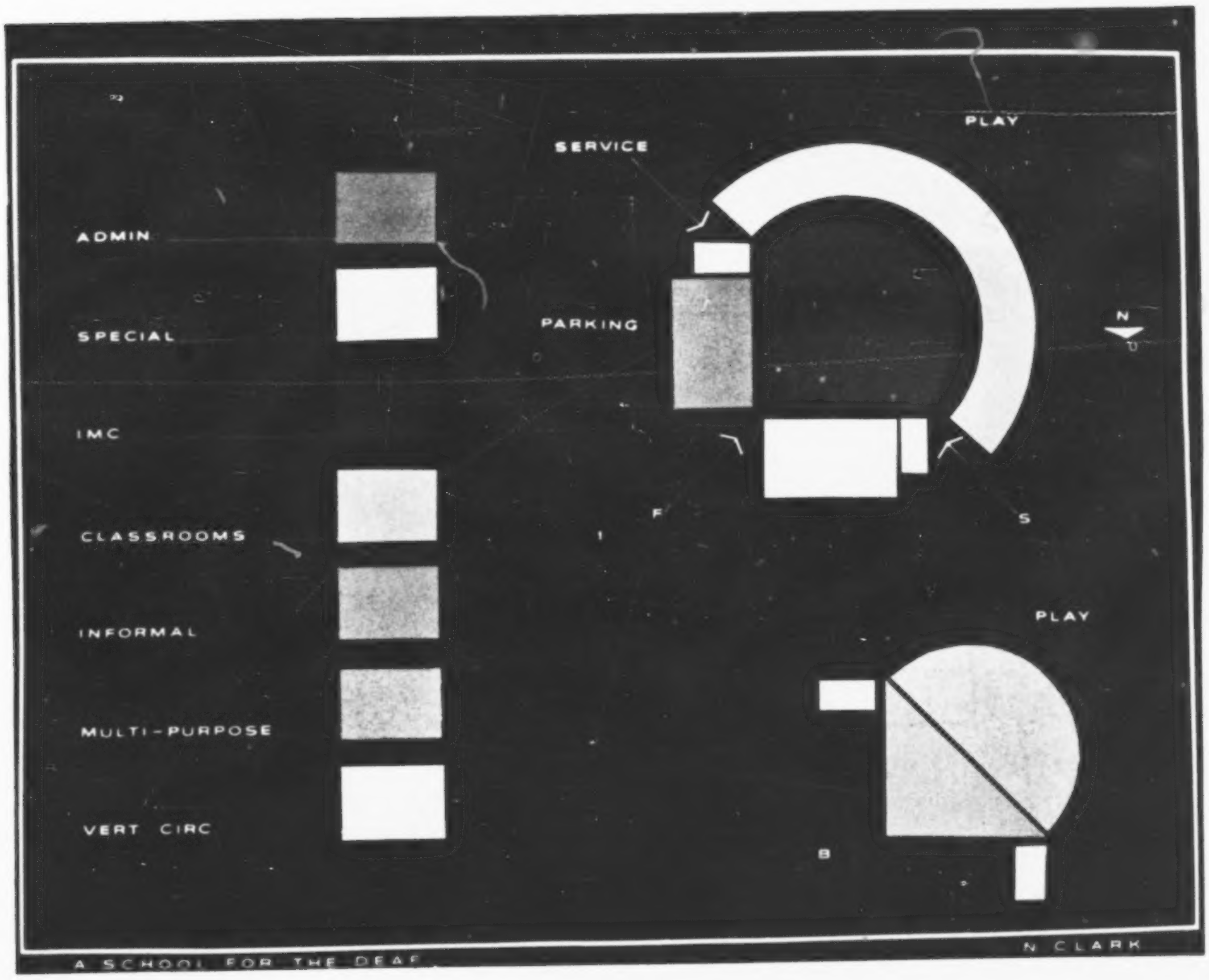

ADMIN
SPECIAL
IMC
CLASSROOMS
INFORMAL
MULTI-PURPOSE
VERT CIRC
SERVICE
PLAY
PARKING
N
F
S
PLAY
B
A SCHOOL FOR THE DEAF
N CLARK

Figure 1. Schematic organization of spaces.

informal gathering place for students and second (F) is the multi-purpose room. From here we go to the vertical circulation spaces (G) which takes us up to the first level (upper right of Figure 1). The upper level has been divided into three areas--administration (A), special uses (B), and instructional. The latter consists of classrooms (D) and the IMC (C). I have two entries--a student entry and a faculty entry--parking for the administration wing, a service entry, and a playground adjacent to the classroom wing.

Now in this plan we can see these areas develop. In the lower level (Figure 2) I've shown the multi-purpose area. The remaining area, becomes the informal gathering space with a theater used for assemblies, plays, and dramas. The music room would be acoustically

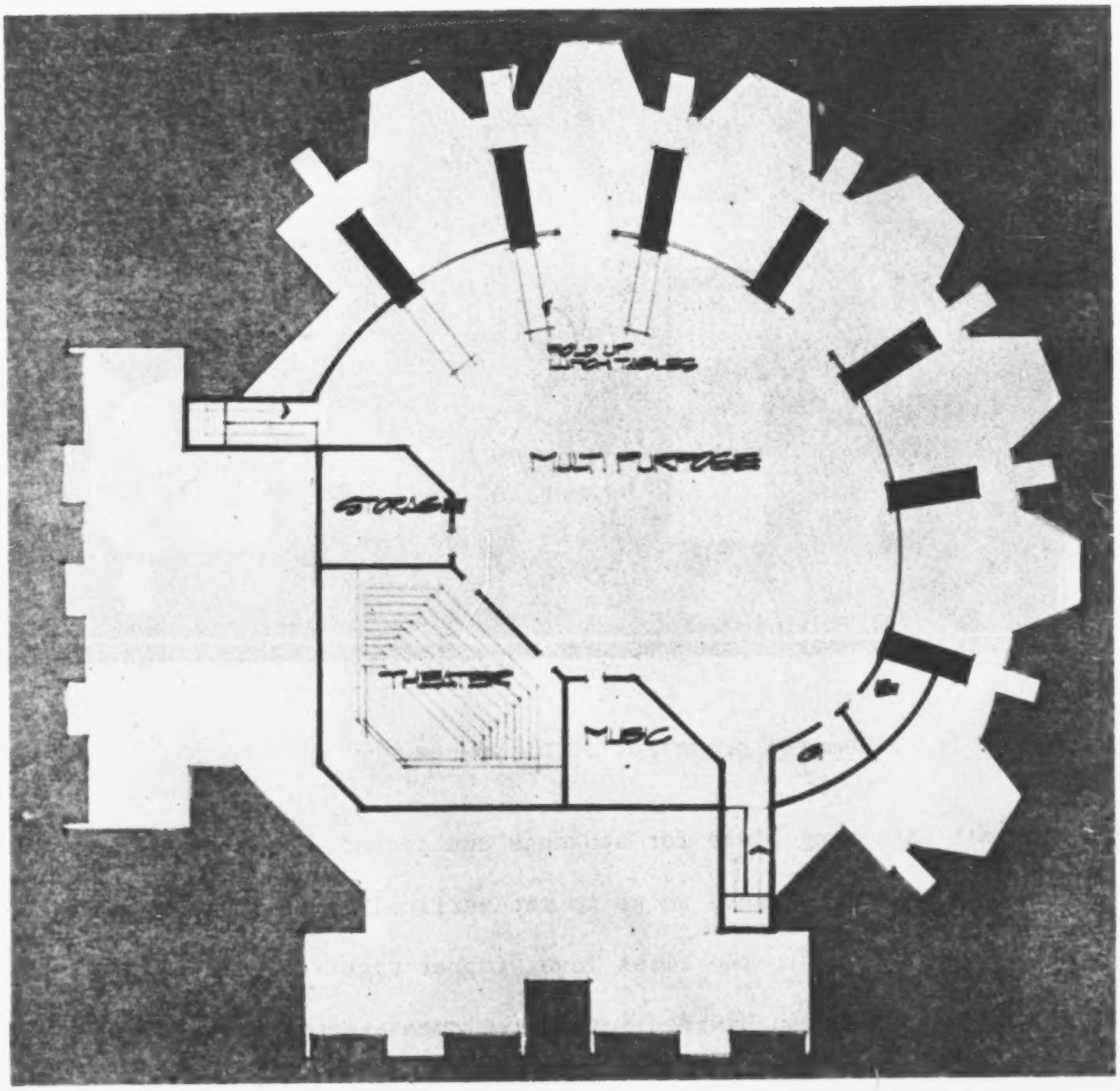
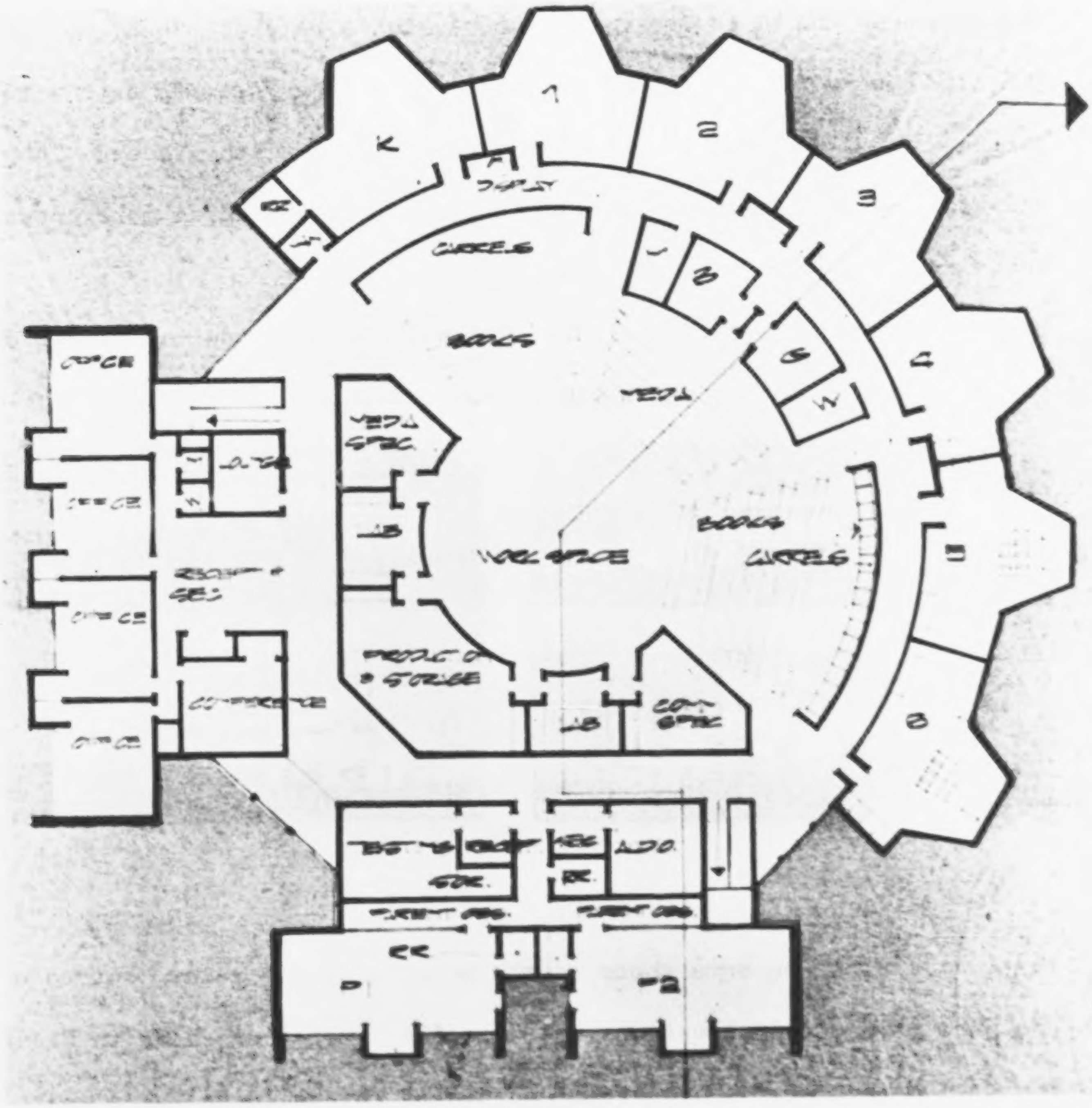

FOLD UP
LUNCH TABLES
MULTI PURPOSE
STORAGE
THEATER
MUSIC

Figure 2. Floor plan for lower level.

treated to facilitate the needs of the deaf child. The large multi-purpose space facilitates the activities of physical education, lunch room activities, and playing indoors when the weather does not permit outdoor play. Rest rooms to facilitate the physical education needs of the multi-purpose room are included.

Returning to the upper level (Figure 3) you can see the classroom wing, the IMC, the special activities area and the administration wing. In the administration wing, I've provided four offices, a conference room for the staff, a reception room and secretary's office, a staff



K
1
2
3
4
5
6
CARRELS
BOOKS
MEDIA
MEDIA SPAC.
LAB
WORK SPACE
BOOKS
CARRELS
PRODUCTION & STORAGE
LAB
OFFICE
OFFICE
OFFICE
OFFICE
CONFERENCE

Figure 3. Floor plan for upper level.

lounge, and a rest room. In the special activities area I've provided a testing room, an audiologist's office, a secretary's office, a rest room for them, and two preschool classrooms with parent observation space and rest rooms. The centrally located IMC contains storage for all books and all media, rest room space, individual study space in the form of study carrels, a large work space for group study, an office and laboratory for a media specialist, production and storage space, more laboratory space, and a communication specialist's office. Then, we see the classrooms perimeting the IMC, and, as you can see, we have kindergarten, first, second, third, fourth, fifth, and sixth grades. The fifth and sixth grade classrooms are a bit larger, facilitating more group activity.

With this next slide (Figure 4) I wish to show you the elevations of the school. We can see these elevations show up a little better in three dimensions on some shots of the model a little later, but to orient you now, relate the elevations below to the floor plan shown in Figure 3. You will note that the classroom section of the building faces west. Playground spaces are in this area. The north elevation shows the

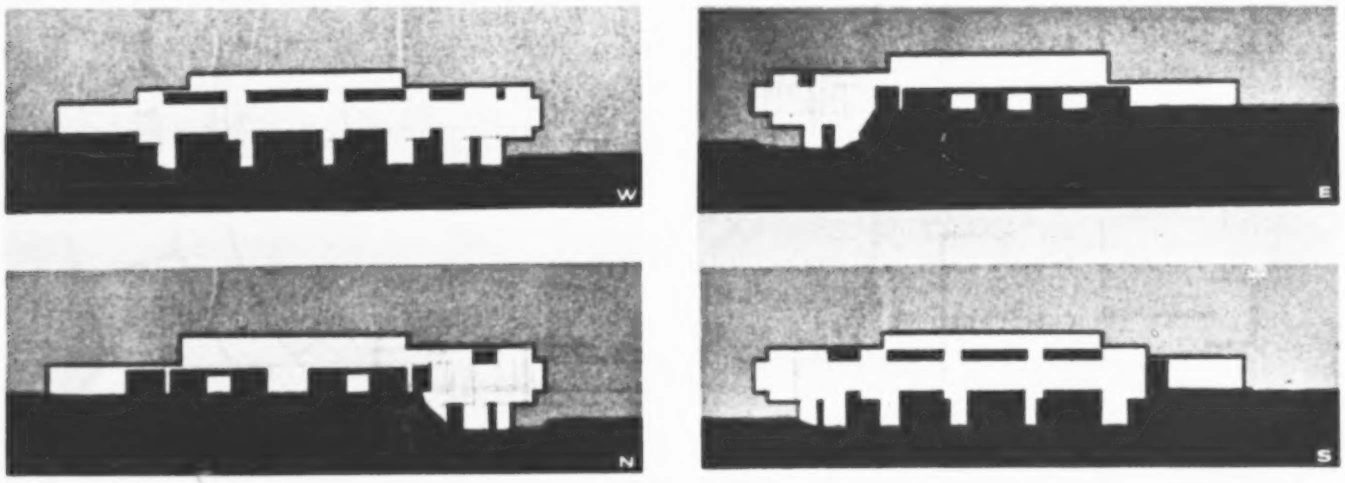


Figure 4. Elevations.

special uses area and some classrooms. The south elevation shows more of the classroom wing, and the east elevation shows the administrative wing and a portion of the classrooms.

In Figure 5 I would like to point out some facets of the site. First of all, we're oriented with north as indicated. The school that Don talked about, Holmes Elementary School, is located approximately as diagrammed. The school sits on a sloping site which is high at this point (X) and low at this point (Y). It's situated in a suburban area off of two secondary arteries. I've provided loading and unloading space for the students at (A) and student entry at (B). The faculty entry is at (C). I have a service drive (D) to the service entrance (E) and a parking area at (F) for the staff.

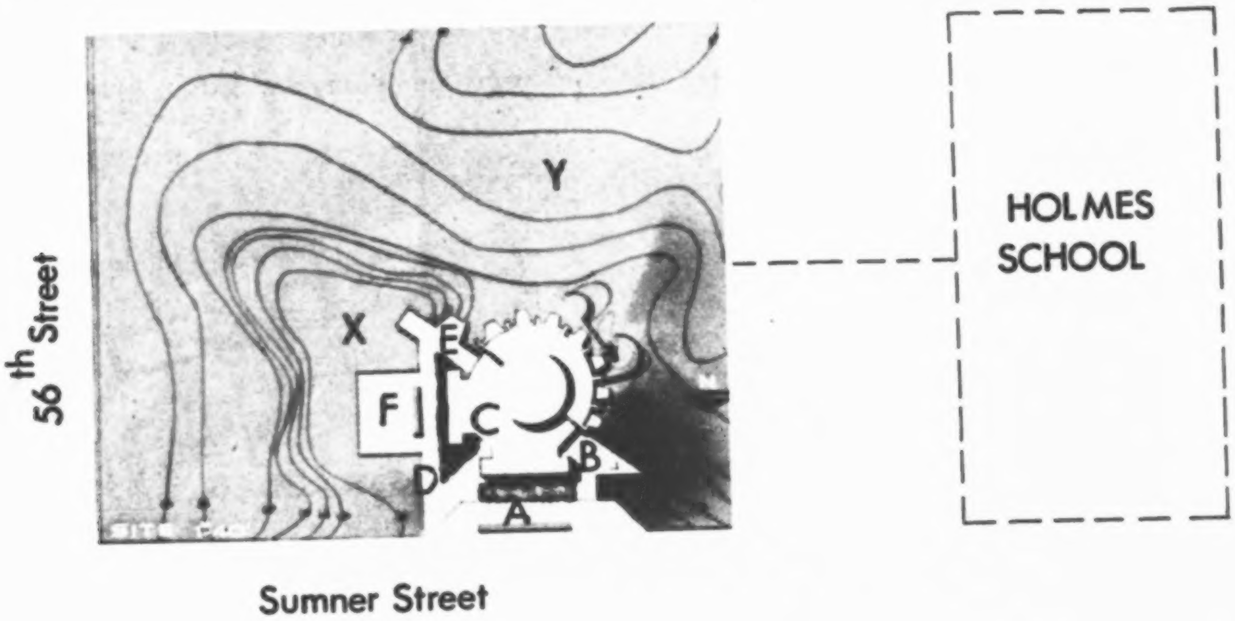


Figure 5. Site characteristics.

Next slide (Figure 6). Here, I'm showing a typical classroom which I've divided into three zones, according more or less, to the study habits of the students and the teaching practices that were revealed in our research. I've provided individual study carrels for individual study, a large work space for group study, and a teacher-oriented space for the teacher-student interaction. The carrels area will provide ample space for the storage of media. The classrooms will have plenty of outlets and power for media equipment and plenty of work space for the student. In this area, I'm providing a large work space with display space and flexible space; in other words, these tables don't have to be here all the time. There is room to move around and for

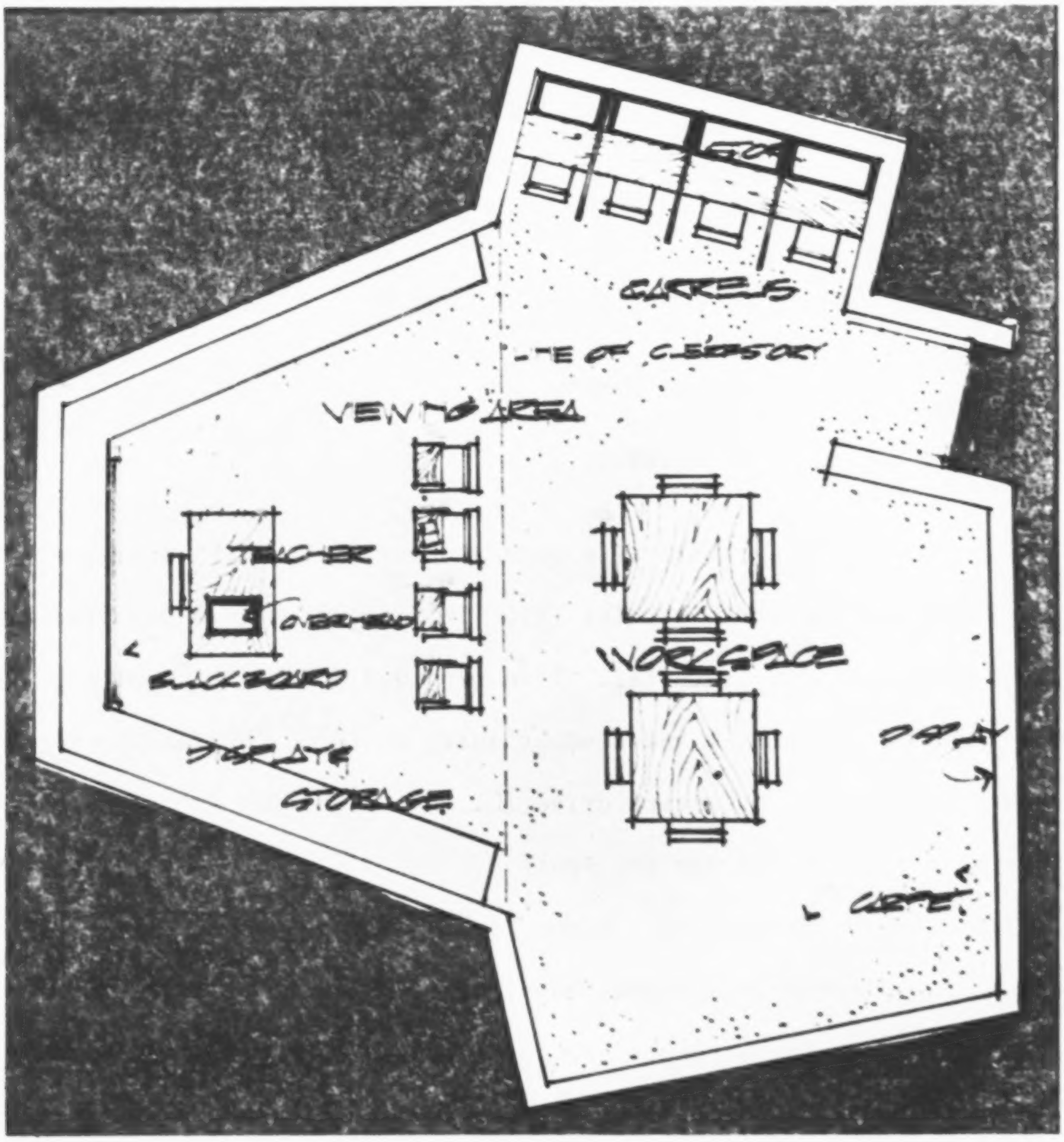

CARRELS
LINE OF CLERESTORY
VIEWING AREA
TEACHER
OVERHEAD
BLACKBOARD
SEPARATE
STORAGE
WORKSPACE
CARPET

Figure 6. A typical classroom.

students to work in a group. I'm anticipating a loop-type amplification system, utilizing walk-away units. The teacher-oriented space I ve designed so that the student's attention is directed toward the teacher and toward areas on which overhead projection and media may be used. This would be a blackboard or screen which is directly in the student's line of sight. The teacher's desk, utilizing an overhead projector, has plenty of storage and display space on either side. Let me point out that this is not a windowless classroom, I've provided a clear story window across here (dotted line) allowing natural light into the room. The way I have situated the window, it is more compatible with the projection systems used in the presentation area.

The next slide, Figure 7, is a section of the building and here you can see the building coming into three demensions. I'll try to

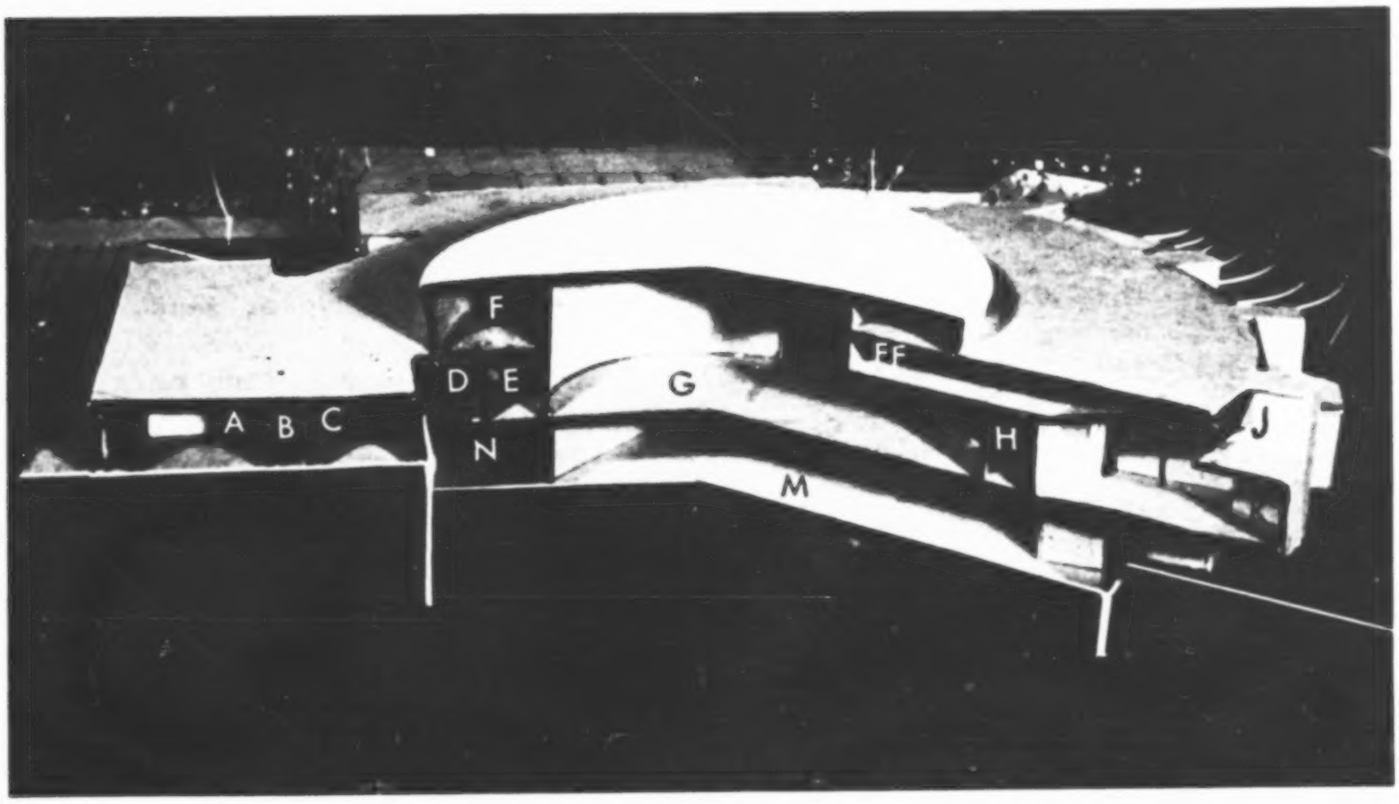


Figure 7. View of cut-away model.

point out some of the major areas of the building as keyed below:

(A) shows a section through a pre-school room

(B) would be a rest room space

(C) is the audiologist's office .

(D) is the hallway

(E) represents part of the production laboratory

(F) represents mechanical equipment space

(G) is the IMC

(FF) is more mechanical space

(H) represents the hallway between the IMC and the classrooms

(I) is a typical classroom

(J) is the clear story window that I spoke of

(K) is the teaching area

(L) is the classroom activity space

On the lower level we have:

(M) the multi-purpose room

(N) the music room

This slide, Figure 8, I have to show you more or less, more of the exterior of the building evolving into three dimensions here. I will point out a few things as keyed below:

(A) loading and unloading drive

(B) faculty entrance and administration area

(C) parking

(D) service drive

(E) classroom wing

(F) IMC area

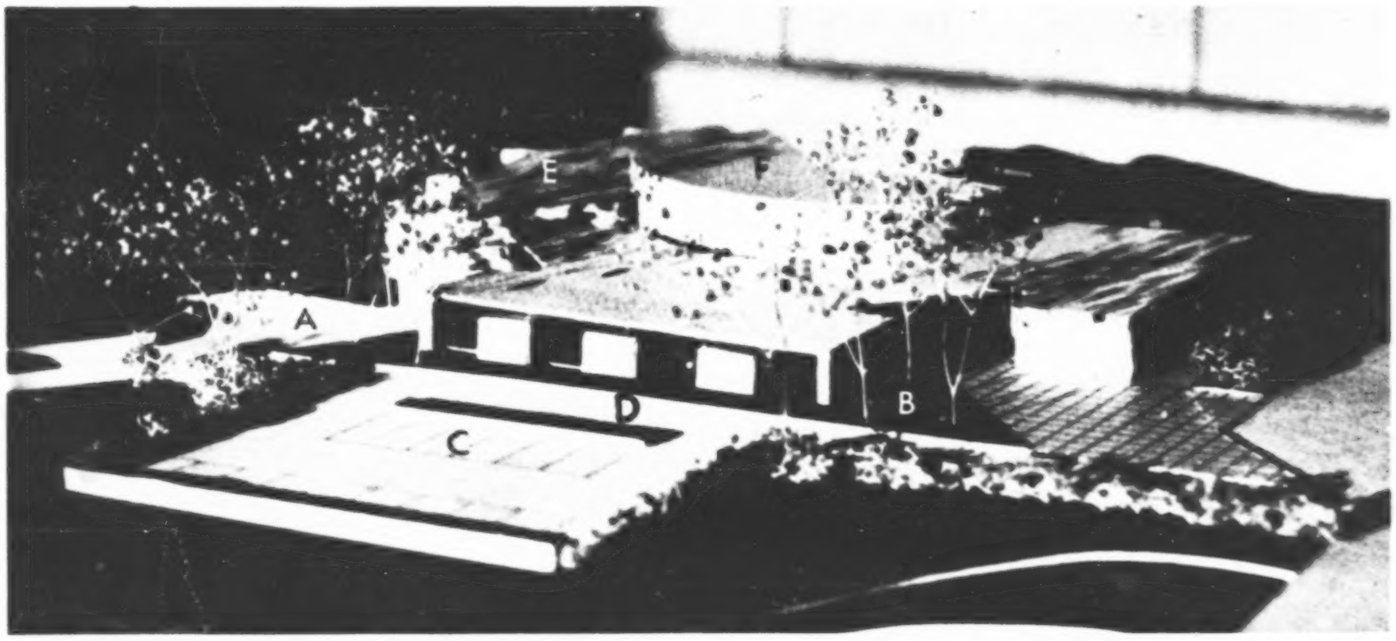


Figure 8. Exterior view.

The portion to the right is the preschool wing with a small patio outside for playing and experiencing things, for a nature area, and things like that.

The next slide, Figure 9, is another shot of the exterior as keyed below:

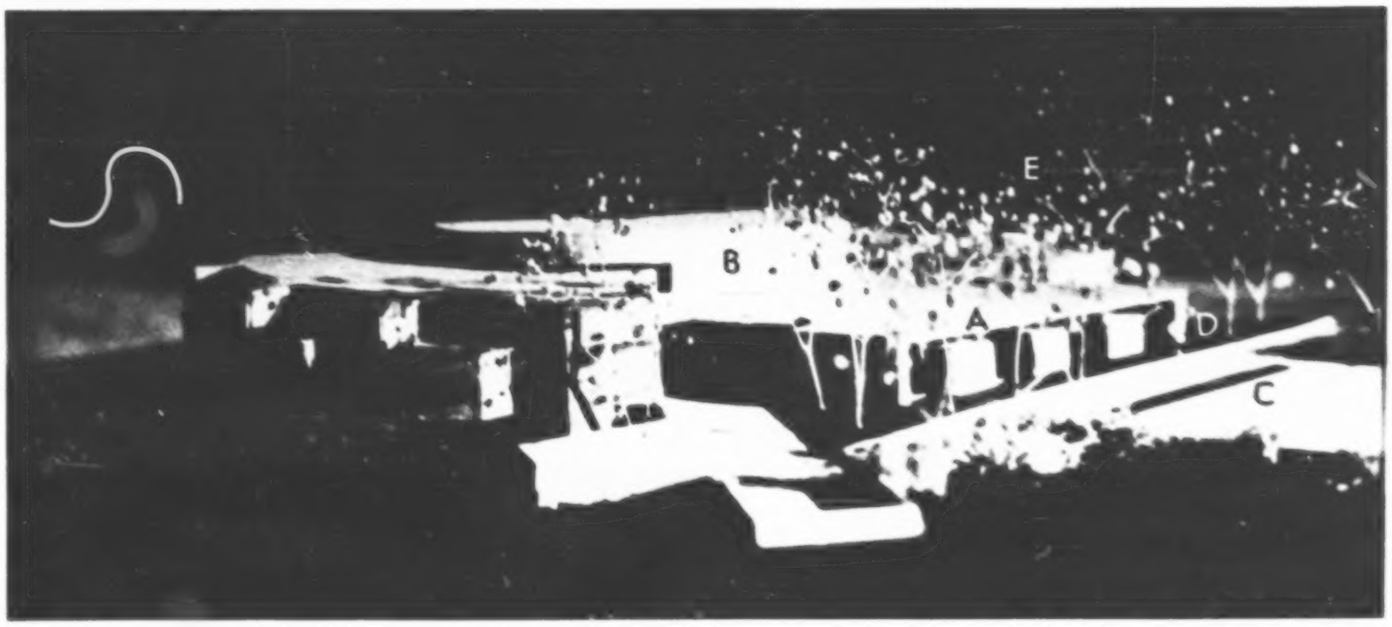


Figure 9. Exterior view of Administration wing.

(A) Administration wing

(B) IMC

(C) Parking

(D) Staff entrance

(E) Special activities area

The last slide, Figure 10, is keyed below:

(A) Service drive

(B) Administration wing

(C) IMC

(D) Ground sloping off

(E) Play area

(F) Classrooms

(G) Clear story window

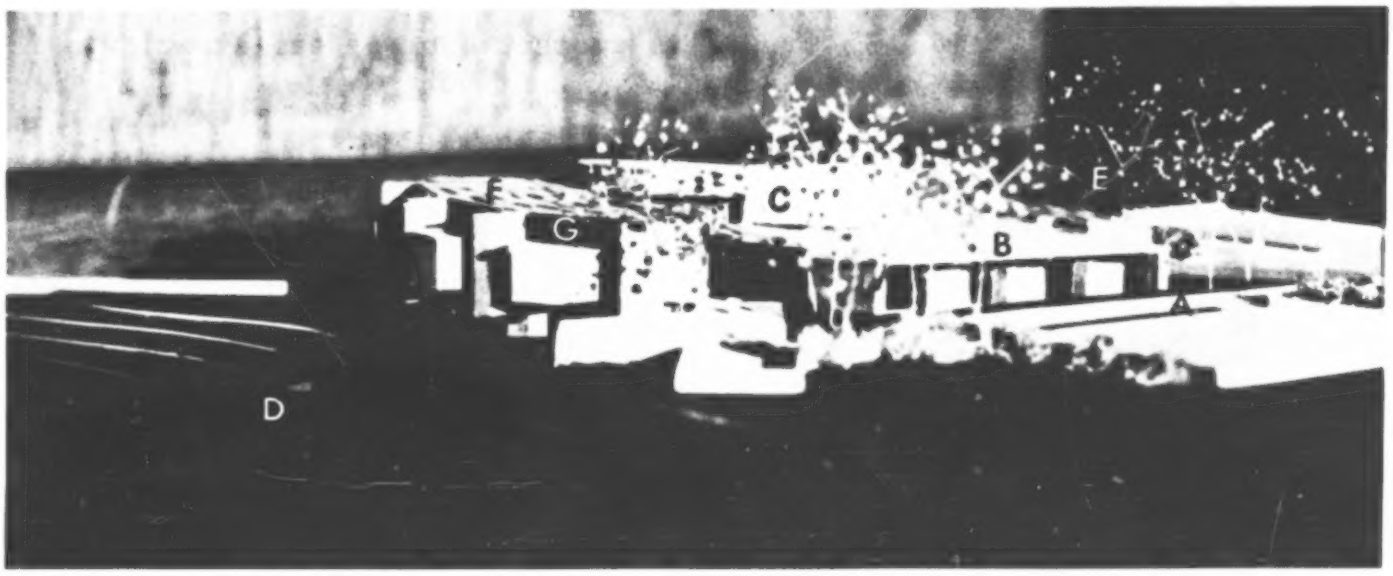


Figure 10. Exterior view of administrative and classroom wings.

The buildings are to be built of prestressed concrete utilizing two structural systems, one within the classroom area and another system within the special uses and administration wing. This slide concludes the presentation. I thank you for the opportunity to make this presentation.

THE EDUCATIONAL IMPLICATIONS OF ARCHITECTURE FOR THE DEAF

by

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Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

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A native of California, Mr. Berenson obtained the B.A. and M.A. degree in Architecture from the University of California, Berkeley. Since then he has successfully combined a teaching career with the practice of Architecture, and today Mr. Berenson is recognized as one of the nation's outstanding authorities in planning facilities for exceptional children.

Mr. Berenson has published numerous articles in professional journals. He belongs to professional organizations in both fields of architecture and education. In addition he is a member of the Aircraft Owners and Pilot's Association.

THE EDUCATIONAL IMPLICATIONS OF ARCHITECTURE FOR THE DEAF

Years ago, in the middle of my apprenticeship, I had a very intriguing, very exciting experience. I went out to a particular school for blind children, and, with the permission of the principal and the children, I asked to have my eyes bound so that I could see nothing. I lived there for a week. The first thing that happened after the initial shock of this profound sensory loss occurred as I was sitting on a bench when I heard someone move up next to me and pull at my elbow. I said, "Hi."

The stranger replied, "Hi. My name is Herb. I live here."

So I said, "Well, hi, Herb. My name is Bert. I'm just going to be here for a while."

"Oh, you're that guy who has come to live here like us for a week."

I said, "Yeh."

He said, "Well, it's dinner time. Let me take you."

I said, "Okay, if you insist."

He insisted, so he took my elbow and off we went through doorways and corridors. At the proper time he would say, "Step down, door next, watch your head," until we arrived at the cafeteria.

"Roast beef, mashed potatoes, and peas," he said.

"Well, gee, how can you tell?" I asked.

To this he replied, "Oh, in two or three days you'll know, too, because you'll learn how to use your nose." Perhaps it was from that moment that I became committed to this particular problem of architecture and the exceptional child.

Having been in this field for a number of years, I continue to look at the problem first in terms of children and then special children. I am an outsider and always will be, but to me, it is a problem of children and who children *are* and what they *do* and what they want to *be*. And it seems to me that it's very possible, that within this highly technological society in which we live, we tend to forget the fact that the human being is first and that technology is second.

I wish to ask questions rather than make statements. First let me say that I am convinced the human variables are the critical variables. We build buildings for people and therefore we must know who and what people are. I do not intend to philosophize because I am not a philosopher; I like to think of myself as a doer. I think the overriding issue in architecture is people, and when this is forgotten by architects, by administrators, by teachers, by anyone involved in a constantly changing physical world, then we have lost a sense of reality of the human condition.

So, I will establish a frame of reference and follow it very quickly with another one. Some of you, I know--those involved in the education of the deaf, in administrative positions, or in the classroom--are justifiably concerned with what happens to you in your school or institution every day. What is required to maintain this place? Are the aisles going to be wide enough for the brooms to go through? What kind of wax do we put on the floor? How do we keep the windows clean? Who is going to maintain the equipment when it breaks down? Where are we going to get staff? True, all of these things are most important, and I don't mean to subordinate them. But I don't think we are, at this moment in time, facing the real problems, the issue at hand. I'd like to address myself to what I think the issue is.

The basic issue is couched in unknowns, and I admit to this. I think that there are architects who don't admit what they don't know, who don't seek professional help in gathering information, in learning the procedures for analyzing and synthesizing this information, and perhaps in some way becoming involved. This, I think, is a tragedy. I must also say, and perhaps the architects in the audience will damn me for this, that I don't think that my profession, which has existed in this country for hundreds of years and, of course, for centuries before that in other countries, has risen to the challenge of doing what I think is necessary. We need to find out what the environment is, what it does or can do to people, and to find those persons, hopefully some of you among them, wo will generate the research or inquiry that is necessary in order that these problems first can be stated and then can be solved.

It is appropriate to say, even if its only a partial statement, that to find the appropriate and relevant physical environment in which learning takes place, whether it be for the deaf child or the hearing child, will indeed catalyze, reinforce, or stimulate learning. I suggest that the environment can be an aid to the teacher; it can be an integral part of her classroom function, and can assist the teaching process in very tangible ways. I am stating simply that information can be transmitted through the environment, and since we are at least partially the products of our environments, we must address ourselves to finding the most effective way of using it.

If one has a sensory loss and impairment, how can we then compensate for this impairment through the environment? I suggest that in finding out what a learning environment should be for the hearing-handicapped child one must begin with his neurological development. I think that many of you are well aware that the neurologists, the child development people, and the physiologists are able to tell us how the small child is stimulated or through what physical and psychological channels he gains information and experience. How, then, is his personality structured through those experiences? The ecologists and biologists tell us without equivocation that we are products of an environment which certainly should closely fit us. If we are not fitted to the environment, there is a pretty good chance that we won't survive. Historically, this has been proven true. But do we indeed fit the environment to us?

I have a note here about the fact that we have become so used to the amenities that our technological society produces that we take them all for granted. We take for granted radios and air conditioning in automobiles; we take for granted running water, plumbing, and a variety of other things. If these were taken away from us, would we adapt? How quickly would we adapt? These are rather gross questions but, if one considers them in the light of how much adaptation must take place in the environment in which children learn, they become a series of critical unknowns. We know very little about how children adapt. We know, I think, a very limited amount about how information is transmitted, and when one thinks about the architects responsibility as being that of designing in all dimensions, the problem then is immediately very complex and in need of serious consideration.

There is, of course, an architecture of sound of which I am sure you are all particularly aware. There is indeed an architecture of sight because most architects view their profession as a visual one. There is one of touch because the tactile world is a very complex one and we learn a great deal from it, and, as I told you, I am convinced that there is an architecture of odor and one of taste. So we're not designing just for the visual world; we're not just making sculpture. We are indeed making a manmade environment out of all of these senses and if one is missing or if two are missing, then it seems to me that we must find out how to compensate for them with the tools we have available. This is no simple task and it is not going to be a task that we are going to accomplish independently.

There are those of you who have dealt with architects before. Hopefully it was a pleasant experience, but usually the kind of response I get is that it was something less satisfactory. We'll recognize that certain demands must be made and it seems to me that these demands must be made in such a way that the architect will know where he must go to get information. It would also seem to me that you should tell the architect to find the pediatric neurologist and ask him how the nervous system develops when there is a sensory loss. We should ask the psychologists involved in human development questions such as: What is the emotional effect on the child? What kinds of things stimulate the child? How can this stimulation be heightened or should it be? What confuses, and how many elements--visual, auditory or tactile--can a child simultaneously absorb? Look at our classrooms. We see some schools today and we wonder really how much of this classroom the child is seeing, feeling, or hearing. Now these are questions. I don't think these are answers. I think that a great deal of work must be done.

I'm always interested, of course, in the architect who views the problem at hand. This means that he carries on his work by going to schools, if that's the case, where children with a similar disability are housed and taught, and he walks into a classroom and he looks for a minute, or an hour, or a day to study the procedures used. Perhaps if he is lucky, he will get to look at the curriculum. He talks to the administrator and he asks things like: What do you like? What don't you like, or what is it that you don't like about your building? Does he do this under guidance, supervision, or with the assistance of a professional like one of you? Can he then analyze the information he gets? I have a point of view about residential institutions for the deaf. I don't think it is the proper place to discuss it, but I certainly have a point of view. I think that by the time the architect is involved enough even to do a small building, he should have a point of view, and should be able to question you with some authority; not about the training or teaching or housing of the deaf, but about the kind of architecture he must make to satisfy your needs whatever they may be.

I think to structure this inquiry and to structure the research that needs to be carried on in this very complex society is not just the architect's job. However, I am quite willing to take some of the responsibility for our errors, of which there have been many, but some responsibility also must be yours. In a sense, I'm asking that, when the possibility arises, questions such as this can be asked and the answers sought in an organized sequential and continuous way and that a conscious effort be made to seek this information. Unless this is done I'm afraid that we will continue, whether we like it or not, to produce anonymous human beings, and anonymous buildings in which they are housed. Now if we add to that problem, which is problem enough, another dimension, then I think that we might have broadly sketched the parameters of this problem of designing the environment to serve a human and humane purpose because there is also a social dimension, and I don't think we can forget about that.

Also, we have today both alluded to and talked about the problem of integrating the deaf child with the normal child--when and how it occurs and under what conditions. How does one reach this point?

I would suggest at this point that, if a comprehensive view of environmental design is ever to be developed, there are a number of things that must be kept in mind. I've mentioned a few before, and I won't repeat them, but one is extremely important. It is the idea of change. It's more than a notion because the world certainly isn't today what it was yesterday. It is said by most educators that ten years hence we're not going to be teaching or training deaf children the way we are right now. It's obvious from your attendance at this meeting that you don't think so either, because you didn't come here to listen to old stories. You have come to listen to new stories and new ideas--at least I assume you have. But I think the point of this is, if we don't know how children are going to be trained ten years hence, we must be able to develop some kind of predictive mechanism to make sure the environment is going to fit the problem ten years from now.

We build buildings now that last fifty years. Is there a reason for us to do this? Is that building that was built fifteen years ago effective now? I suggest that we are going to come to a time and it may well be soon when we'll have a disposable building. And I'm going to suggest to you that fairly soon you will be using an audiovisual mechanism like the disposable furniture we have right now, and I suggest to you that this disposable concept is not unrealistic but something that can and will be developed relatively soon.

We find it difficult to accept modern music because you and I weren't nurtured on it. For the child who is two years old and hears electronic music from this time onward, it will not seem unusual or hard to adapt to or have some rapport with it as it might seem for us. This may also be true of what kind of jazz was being played in 1940 and what kind of music teenagers are listening to now. I suggest then that this idea is not unrealistic--the idea of a partially disposable environment.

Once you keep in mind that these social dimensions that I'm talking about must come into play, it would seem to me that we must start thinking about a mobile building as something more than a trailer. Now, when a school district runs out of space, the assistant superintendent for buildings and grounds calls up the prefabricator, or the packager, or the trailer manufacturer and says that he needs nine trailers on Monday morning, that he has 80 children who must have a place to go to school. I doubt seriously whether this is the answer to the problem. I think that we have the predictive mechanisms available to us now that will tell us how to avoid this. We just do not use them.

What I am trying to say is that I don't think today's environment is necessarily conducive to learning. Whether it is comfort, mechanical efficiency, or beauty, in traditional twentieth century terms is of little consequence to me; whether it works for children and teachers is of great consequence to me, not only now but ten or twenty years hence. If we are required to build a building that lasts seven years and then we destroy it and build another one to last five years, then we must have the resources to do it. There is some logic to this as well as need.

Before I show you some slides of things and ideas that I've been working with, I'd like to very briefly describe to you the project I am directing for the Council for Exceptional Children. I will eventually ask you for your assistance in this. I believe that we are not completely aware of the state of the art, another expression which Madison Avenue must have conjured up one dark night in the cocktail lounges along the Avenue. I think we must know where the state of the art is by having seen or been instructed to see what happens in so many classrooms. I have also noticed that among teachers there are many inventors. Among these inventors are people who could give to this problem of educating the deaf--or any child--new insights and perhaps a kind of directness to a solution that presently doesn't exist in the literature of the exceptional child.

We are going to try to survey the state of the art of the work, always a hard thing to do because people are presented with a great folder of paper and they always say, "Oh, another one of those." Well, let me suggest that if you get one of "ours," it won't be another one of "those." On the other hand, we think it is important that we find out where we stand in development of our environment. It will be a critical study and the results of the study will be published.

I would state to you that we have no intention of producing a "how to do it" booklet. The kitchen-table architect is still with us. We have about 197 million of them in this country and it seems to me that we don't need any more. We're not trying to find out how to do it for other people; we're trying to find out what needs to be done.

The second component of this research project has to do with testing the environment. I have not mentioned experiment for a couple of reasons since most experimentalists do not think of architects as researchers, and they certainly do not think of them as developers of research methodology. I think that slowly we are coming to a point where it is incumbent upon the profession to begin to understand this kind of technique and we at the Council are attempting to develop a system by which we can equate the usefulness of a classroom with the curriculum. Certainly the variables are almost infinite. If, on the other hand, we carefully organize this effort so that these variables are identified one by one, perhaps we can say what a child is able to see, or cope with, or understand over a period of time. So, very briefly that is what we are attempting to do.

Through illustrations I would like to suggest what kinds of thinking, what kinds of conceptualizing generated this kind of architecture or environmental design. It would seem to me that even though this may not directly influence any of your problems, nor need you necessarily agree with these kinds of things, they are based on educational and behavioral base lines and on judgments, but not predispositions and not prejudices and not proclivity to make sculpture.

Diagrams can be made to indicate how people talk with one another in various kinds of configurations. An effort was made and a rather successful one to find out something about peripheral relations and something about peripheral sight. In the process of doing this an effort was also made to find out whether peer group relationships were actually set up because of these configurations, the relationship of people in space. Did leadership actually evolve? In a sense, can it enclose geometry? The data is thus far incomplete. The indications are yes to all those questions. It would seem to me that geometry does not have to be based on whether it looks pretty; it can be based on the human variables.

Figure 1 is a model of a classroom for deaf children. This classroom was designed to be constructed in Boston at the Horace Mann School for the Deaf. It has been conceptualized this way because when a deaf child is lipreading the teacher must get down to the child's range of vision. The idea is to raise the children to a level where the teacher can not only touch them but where the children can see the teacher's mouth and vice versa. In addition to this we must retain a certain kind of flexibility. I haven't mentioned the word "flexibility" because I find it a difficult concept to cope with and because I don't really think there is such a thing. This classroom scheme has been modified because we are aware of the impact of individualized instruction. Independent learning is a current technique, not a thing of the future, and it is for all children,not only the deaf.

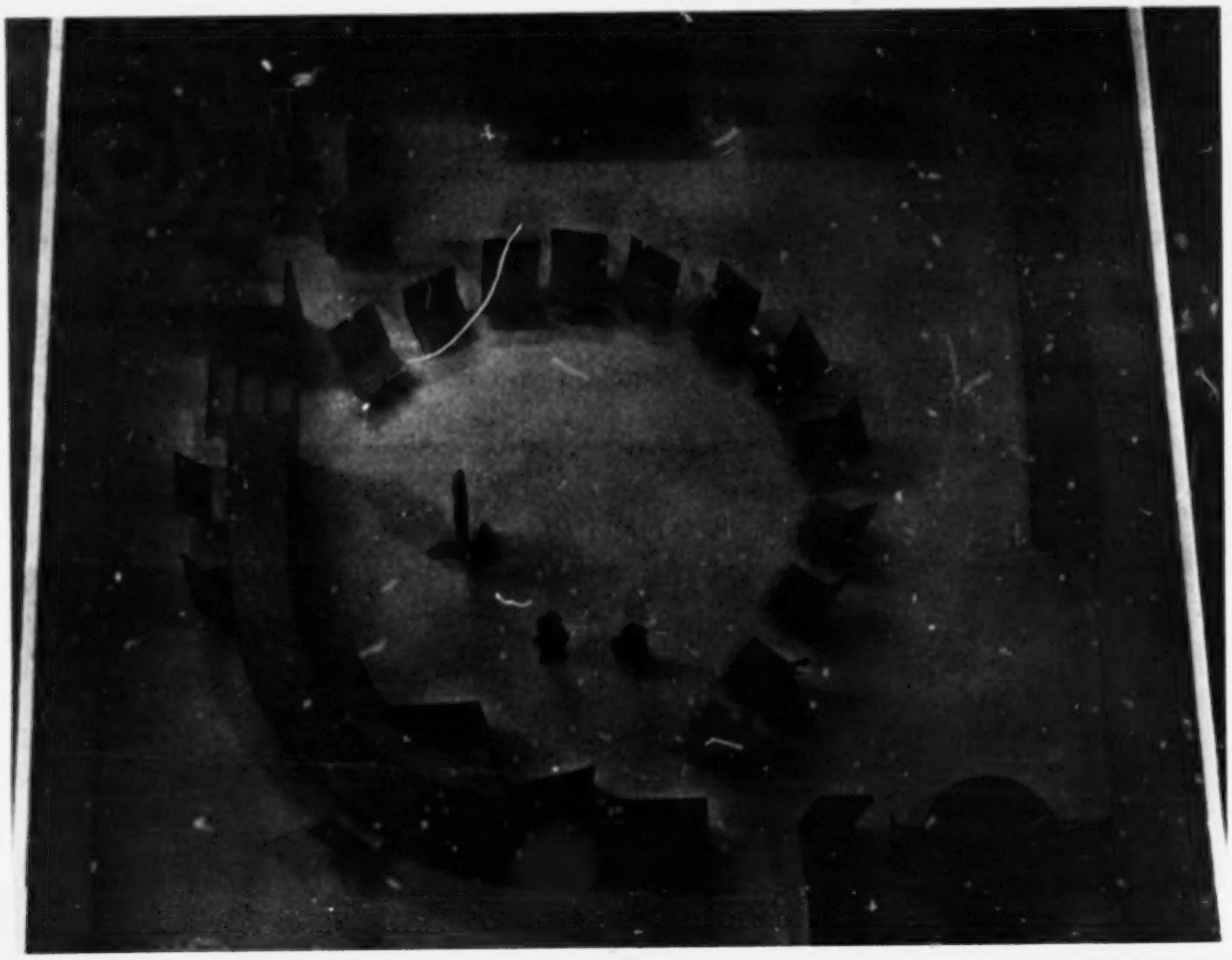

Figure 1.

So, in our planning, the children were raised on a platform and the teacher was close. We attempted to measure the level of anxiety in relationship to the proximity of the teacher and the management problems--whether or not the teacher's aide is going to relate or reduce these manageable problems through this kind of configuration. These are the factors which are felt to be important.

Obviously it is possible to seat the children and use the front of their desks for an information resource. We have been experimenting with swivel chairs on the basis of what we were told after asking a neurologist whether they associated a visual problem with deaf children who exhibited extreme righthandedness or lefthandedness. He referred us to a paper done 35 years ago which revealed some very interesting information. Does one compensate for this by allowing the children to be in a natural position when he writes or draws? For this reason the swivel chair is being tested.

Figure 2 is a model of a very small classroom that was done primarily for neurologically impaired children, some of them with limited sight. The rationale is based on what to do with surfaces or what do you allow the children to do with surfaces. What do you do with a chalkboard? Does it

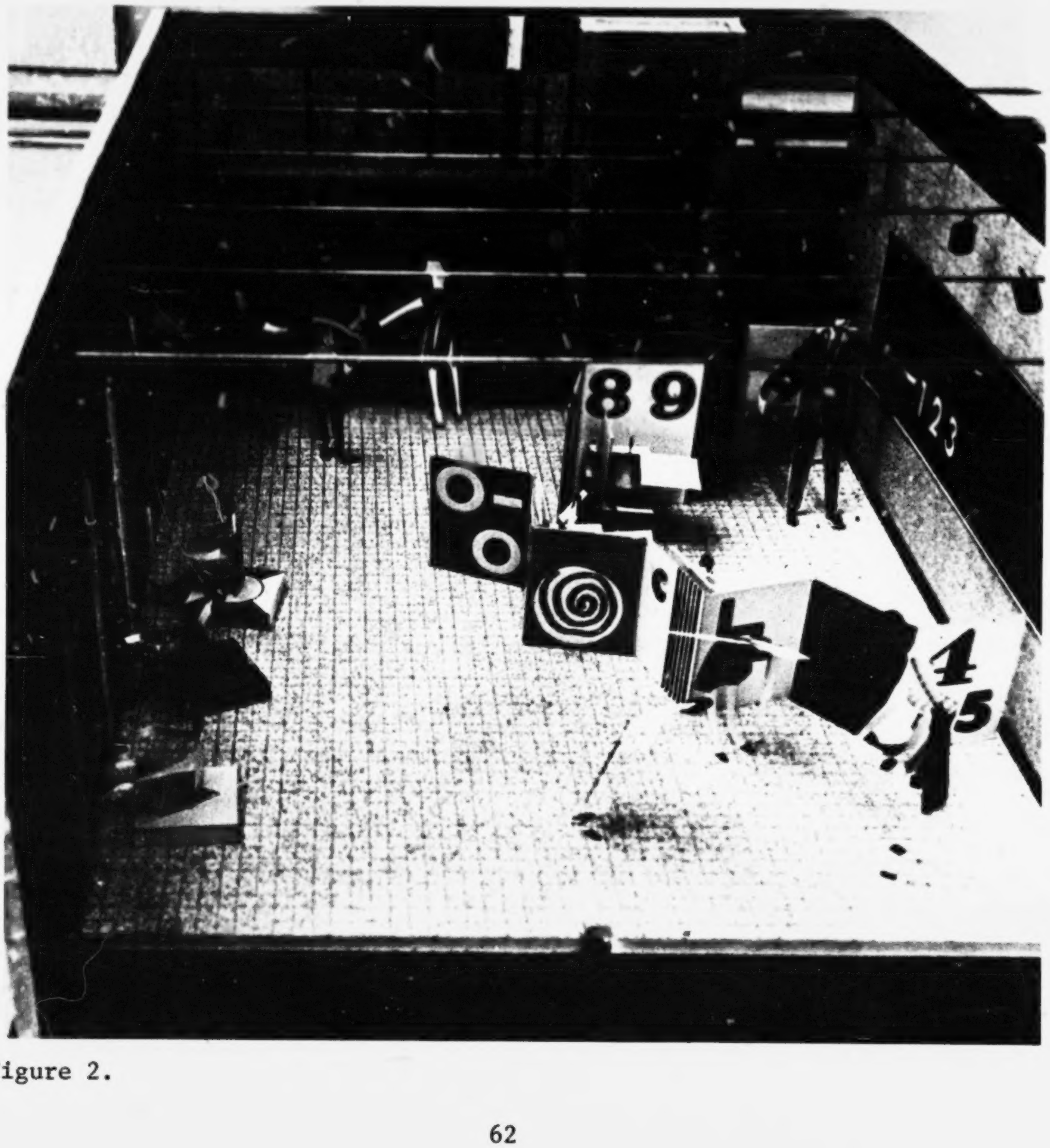

Figure 2.

have to be against the wall? Can children sit on the floor and work at a chalkboard? Can it be moved across the room? What do you do with the lights? How can the light inform you of events? I think of lights as a theatre system where the light level can be raised, lowered, or spotted so as to emphasize specific areas. Is that flexibility?

In this illustration (Figure2.) I want you to note some geometric configurations based on a particular teaching method using Strauss materials for children with learning disabilities. Children need to know the limits of their world, so they are each supplied with their place which, for a period of time, will be their world. But we also know that adaptability will allow after a period of time, or maturation, or understanding, or reduction of anxiety, a bigger and broader world. Shouldn*t the environment change then in order to allow the child more opportunity to explore something beyond this first easily understood, simple, and direct learning world. These configurations and perhaps, many others will be tested against curriculum, against information, against the ways the children and teachers actually behave towards one another. Whether there is a need to be close, whether there is a need to be independent is something we must allow the researcher to find out with some reasonable assurance, perhaps over a long period of time. Whether this hypothesis, that the world is expandable and changeable and that we can introduce this environment into an existing facility and test it, is valid must also be determined.

Figure 3 shows cardboard pieces simply cut to the size of the child because , unless we get involved in the anthropometrics (the actual dimensions) of the child, we're making a serious blunder trying to generalize furniture. Little kids are sitting on big furniture and big kids are sitting on very little furniture. Anyone who is a parent knows that it's always very uncomfortable to go visit the teacher on Parent-Teacher Night because you're always forced to sit on those little tiny chairs. All of this is furniture that can be made by the child. The reason it can be made by the child is because its all connected by friction. The reason why this was done in the first place is because someone in the Office of Economic Opportunity said, "Oh, wouldn't it be wonderful if the child could have his own desk and chair after he finished our Head Start summer." The only problem was that we had to be able to manufacture these for 75¢. So this desk and chair was made for 75¢. There is a desk and chair for a smaller child and if it's turned over the other way its for a child sitting on the floor. It all seems to

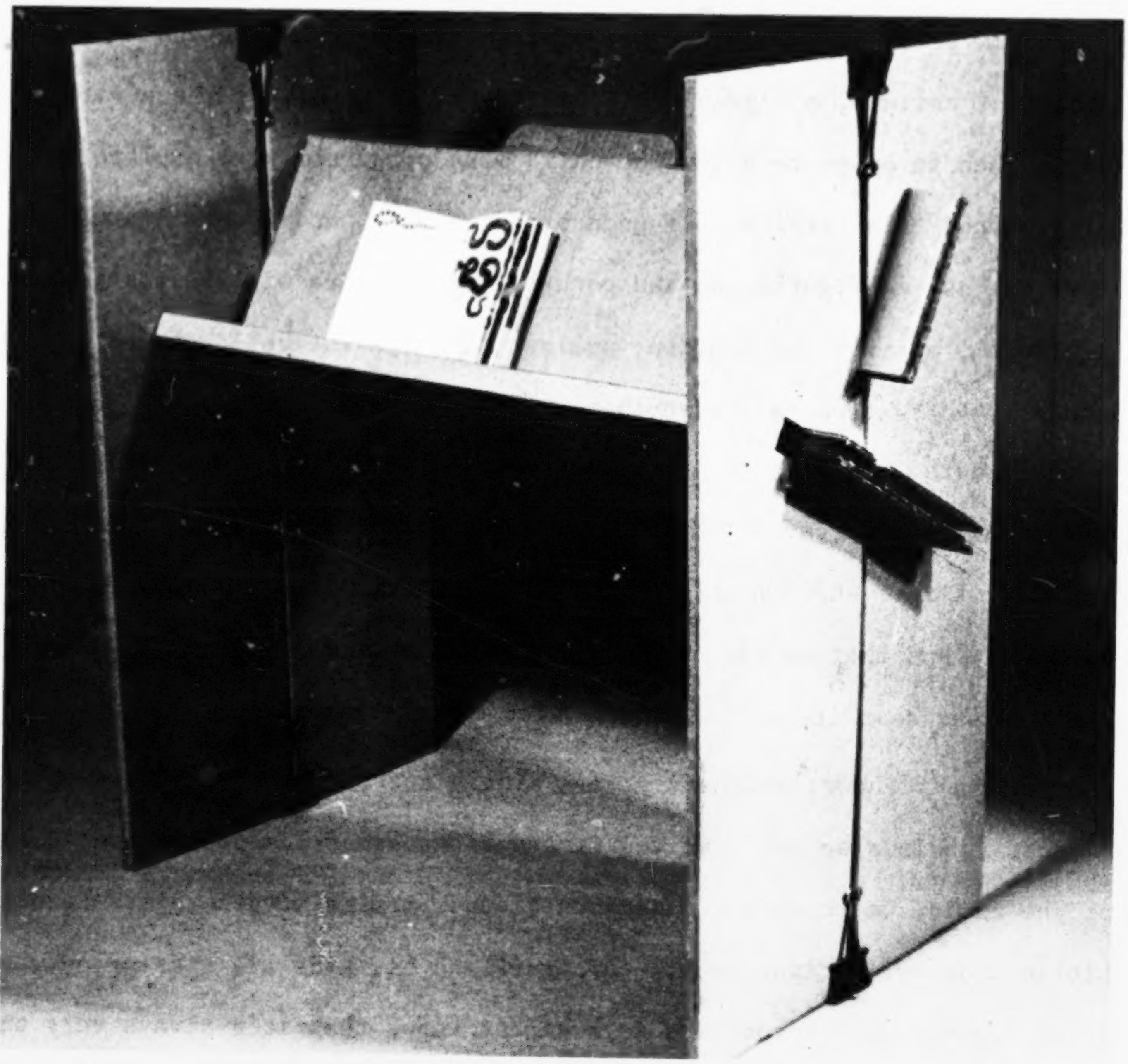

Figure 3.

work the same and it all costs 75¢. If it wears out in a year, you throw it away, and when it's made by the child, perhaps he'll protect it and, if he doesn't protect it, he'll at least know what it's for.

Figure 4 is a drawing of the back of a classroom for emotionally disturbed children which consists of eight regrigerator cartons. We were asked once why it was the destructive child had no place to go, except out in the corridor. We in turn said,"Why don't you give each child a place to go that will be his own place and perhaps after a period of time he will go there without disrupting the remainder of the class?"This is a drawing of what the children actually did. They stacked these boxes, they decorated them, and they cut in them. The fact is, they did indeed, without being directed, use them as their own crises spaces, eventually their own social spaces, and even after that a learning space, something that they knew and understood.

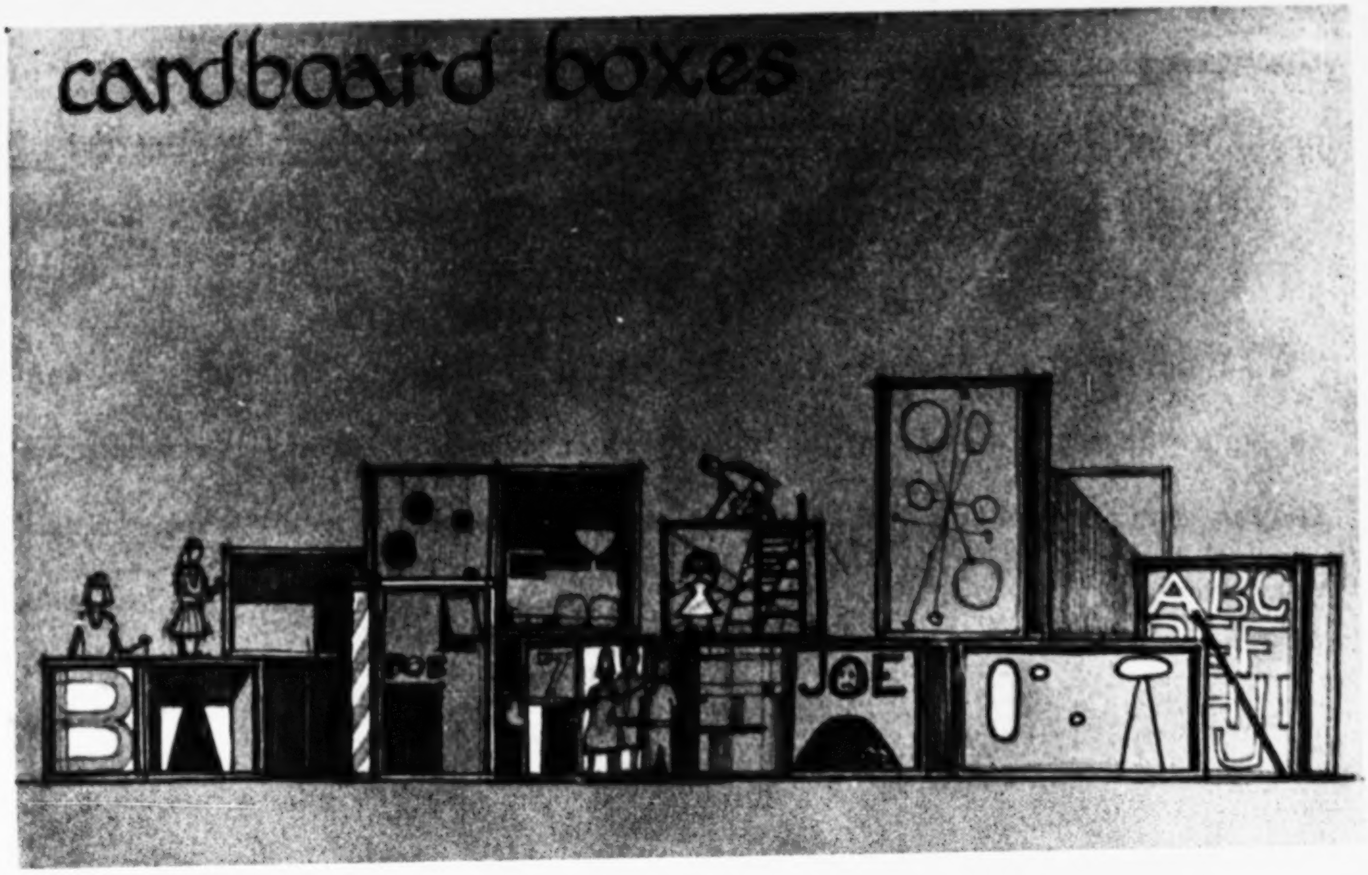

Figure 4.

If I were to identify the kinds of things which influence the decision making process, I would say that now it's 90% intuition and 10% fact. I would further suggest that when fact becomes 40% and intuition becomes 60%, the creative effort of the design will be heightened; it will be made more positive, more reliable, more useful, more lasting, and this can only be accomplished if the opportunity exists for the investigation, the effort, and the committment. I could stand here and talk for the rest of tonight, tomorrow, and the following days saying that the administrator, the board, the architect must indeed pursue this course or else the usefulness of this craft which I represent will diminish. As an architect, a committed one, I would regret this and I think teachers and administrators in schools for the deaf would also regret it.

I should like to again thank you all for your attention, and ask you to consider the issues and accept them or reject them on their merits as issues independent of the personalities who might present them. Thank you very much.

ACOUSTICAL DESIGN OF CLASSROOMS FOR THE DEAF

by

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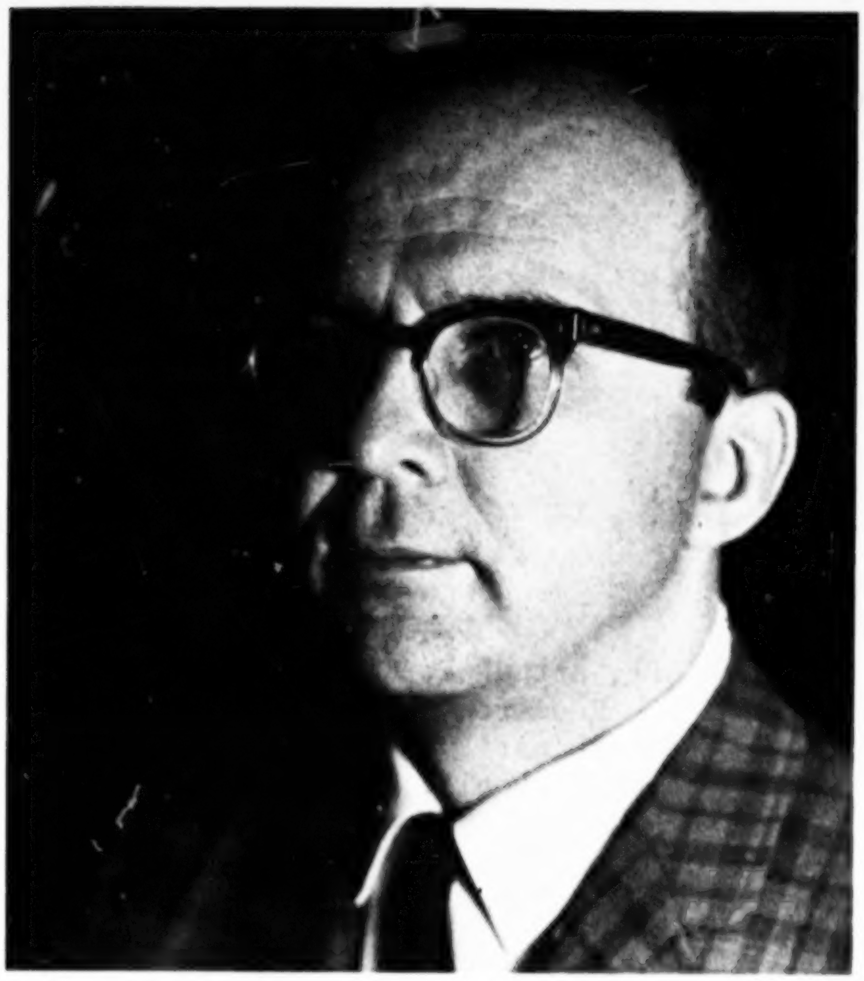
Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.



Arthur F. Niemoeller is a Research Associate at the Central Institute for the Deaf and Associate Professor of Electrical Engineering at Washington University. A native of St. Louis, Dr. Niemoeller received his B.S. degree in electrical engineering from Washington University in 1952. He served in the U.S. Army as a radar electronics instructor from 1952 to 1954 and then returned to Washington University where he received a M.S. and a D.Sc. in 1956 and 1961 respectively. Both of the advanced degrees were in electrical engineering.

From 1954 through 1961 Dr. Niemoeller was a Research Associate at Central Institute for the Deaf. From this position he moved to IMB Corporation in Poughkeepsie, New York, as an associate engineer, and then from 1962 to 1964 he was an Assistant Professor of Electrical Engineering at Vanderbilt University in Nashville, Tennessee. In 1964 he returned to CID and Washington University.

The research activities and current interests of Dr. Niemoeller are concerned with the calibration of electroacoustic transducers and the development of instrumentation for research in the physical, psychological, and physiological aspects of speech and hearing. He is currently teaching courses in statistical communication theory, signal analysis, and architectural acoustics.

ACOUSTICAL DESIGN OF CLASSROOMS FOR THE DEAF

Introduction

The fundamental premise in the acoustical design of any classroom is that the speech level must be sufficiently high above threshold and the noise level sufficiently low so that the rate at which information can be transmitted to the student is maximized. In classrooms for normal-hearing students the way to achieve this is (1) to have a low ambient noise level in the room, and (2) to have the room optimally reverberant to effectively increase the signal level without decreasing intelligibility. In classrooms for the deaf where group hearing aids are used, large signal-to-noise ratios at the children's ears can be provided easily if the teacher will hold the microphone close to her lips. Clearly, if the speech signal at the microphone is sufficiently high, then for any reasonable amount of noise and reverberation a signal-to-noise ratio that is adequate for good communication will exist.

In this paper it is assumed that at times either no electronic amplification or at most only individual hearing aids are available, and that the teacher will be more effective in an acoustically well-designed classroom. With these assumptions, the acoustical design of classrooms for the deaf and for the normal child are quite alike. The only difference is that if noise is more deleterious to the deaf, then the signal-to-noise ratio for them should be even greater than for normal-hearing. In this sense, classrooms for the deaf should be like normal classrooms that have been acoustically "over designed".

To summarize, the objectives in the acoustical design are to provide large signal levels to the student by making the classroom optimally reverberant and to provide low noise levels by acoustically isolating the classroom, so far as it is possible, from its surroundings.

Reverberation Time

Classes of the deaf are usually small, and the classrooms in which they are taught are usually small also. Most of them are less than five thousand cubic feet and are rectangular in shape with no one dimension very much greater than the others. The reverberant sound field in such an enclosure will be relatively diffuse and uniform and, therefore, the acoustical absorption for proper reverberation can be placed on the floor, ceiling or walls with almost equal effectiveness. An effective strategy in controlling reverberation is to determine (1) the total amount of acoustical absorption that is required for optimum reverberation, and (2) the amount of absorption before treatment that will exist from the students, desks, and untreated surfaces. The difference between optimum absorption and absorption before treatment is the amount that must be added, and it can be applied to those surfaces that are convenient and result in an effective classroom.

An acoustically hard front wall in the form of a chalkboard is both pedagogically and acoustically wise, particularly in those rooms that are rather long compared to their width. The hard surface will help project the teacher's voice to the rear of the room at least when she is working at the chalkboard.

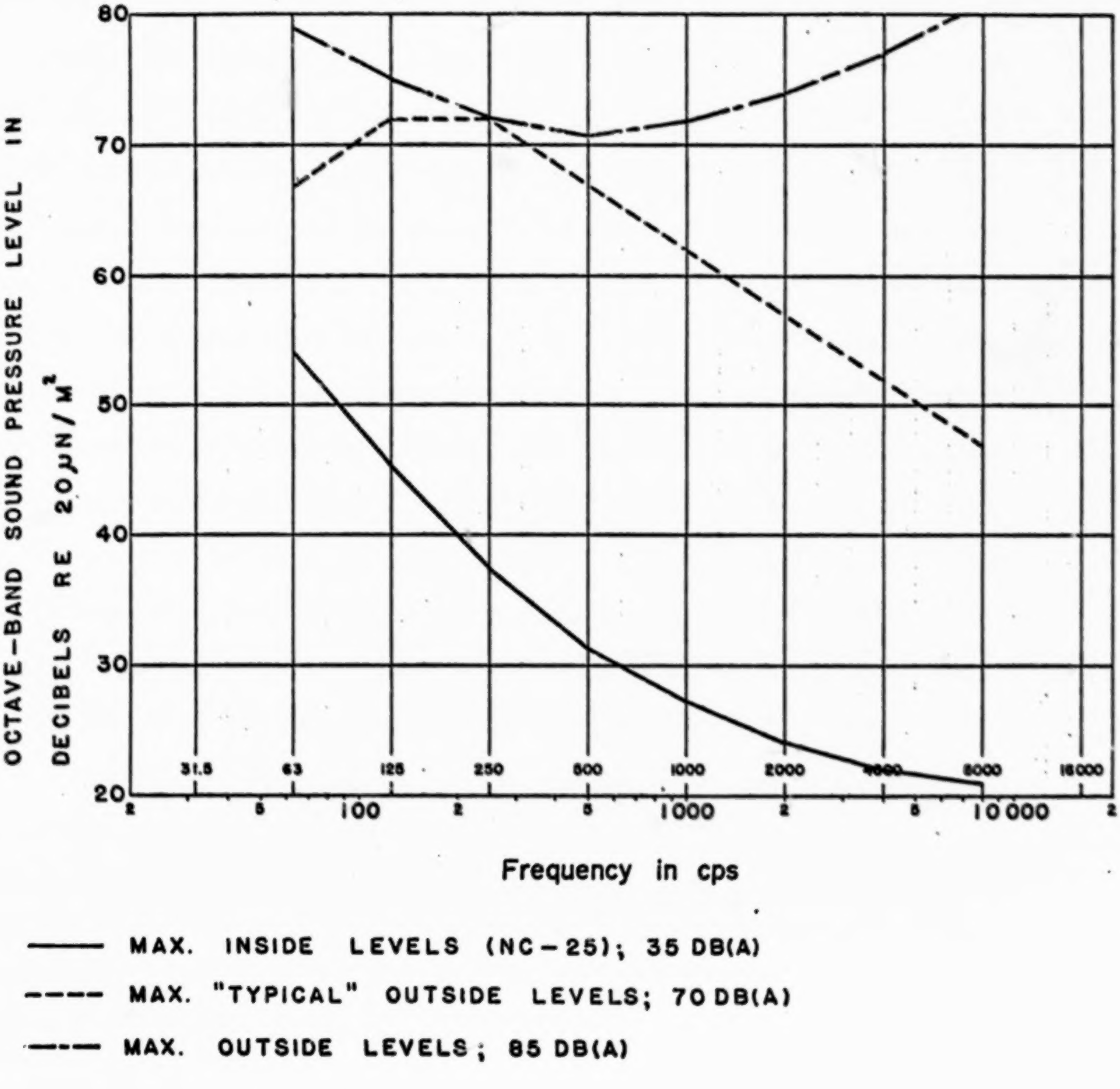
Carpeting on the floors of all classrooms and corridors is essential. It will inhibit the generation of air-borne noise and structure-borne noises from scuffling chairs and feet and from dropping books. Structure-borne noises are particularly troublesome since they propagate through the building structure into adjacent rooms causing them to be noisy as well. Acoustical absorption, in addition to the carpeting, can be applied to the ceiling and walls so that the reverberation time over the frequency range of interest is approximately 0.4 seconds for small classrooms of 2000 feet^3 volume and 0.6 seconds for larger rooms enclosing 10,000 feet^3. These times are consistent with those given for normal classrooms by architectural acousticians such as Beranek (1) and Knudsen and Harris (2). For the deaf, the same design goals are used, but estimates of absorption should be biased so that errors, if any, favor a shorter reverberation time.

The acoustical absorption provided by the teacher and students generally should be included in computing the reverberation time. However, in most classes for the deaf where both the number and size of the children are small, the total absorption from them is likely not to exceed 10 percent of the total room absorption. The reverberation time, therefore, will be relatively independent of the students present.

Noise Criteria

Noise criteria for classrooms for the normal-hearing are adequate for the deaf as well, provided the design for achieving these criteria is sufficiently conservative to insure that they will always be met. Octave-band noise levels should not exceed those indicated by the curve shown in Figure 1. This is commonly referred to as the "NC-25 curve" and can be found in Chapter 25 of Noise Reduction by L. L. Beranek (3).

FIGURE I



SUGGESTED MAXIMUM NOISE LEVELS ABOUT CLASSROOMS FOR THE DEAF

Most room noise levels will not exceed those of the NC-25 curve if their sound level, as measured using the A-weighting scale of the sound level meter, does not exceed 30 dB (A). The equivalent sound level as computed from the NC-25 curve is 35 dB (A), but this level has been lowered by 5 dB in order to accommodate those noises in which the low-frequency band levels are less than those indicated on the NC curve.

Maximum noise levels outside of the classroom can be established by noting that interior classroom walls with noise reduction (NR)[1] greater than 40 dB at 500 Hz are usually not economically reasonable. For example, the required transmission loss (TL)[2] of the walls of this room may be as great as 45 to 50 dB, depending on the interior absorption and the surface area exposed to the noise. A four-inch wall of solid concrete block with plaster on each side will give a TL at 500 Hz of about 45 dB, and this wall would be quite expensive to build[3]. Exterior walls with windows and doors and with TL greater than 45 dB are equally expensive. Therefore, with the assumption that the maximum NR at 500 Hz is 40 dB and that the NR increases 5 dB for each doubling of frequency, the upper curve of Figure 1 can be drawn. This curve gives the maximum octave-band noise levels that may exist in areas about the classroom in order that the interior noise levels not exceed those specified by the NC-25 curve.

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[1] The noise reduction provided by a wall of an enclosure is the difference in the average sound pressure levels (in decibels) as measured outside and inside of the enclosure. This quantity depends on both the room absorption and the transmission loss of the walls.

[2] The transmission loss of a wall is 10 times the logarithm (base 10) of the ratio of sound energy incident on the wall to sound energy transmitted through it. This quantity depends only on the wall itself.

[3] Current cost estimates for this wall are slightly less than $2.00 per square foot.

Noise specified by the levels of the upper curve of Figure 1 would result in a sound level of 85 dB (A). However, if a single-number criterion for maximum exterior noise is required, and this is an A-weighted sound level, then the weighting must be applied to a "typical" exterior noise. The spectrum of such a noise might appear as shown in the dashed curve of the figure. It is labeled "maximum typical outside noise" because none of its octave-band levels exceed the established maximum levels. This noise has a sound level of 70 dB (A), and if we again allow a 5 dB cushion for noises not so typical, it can be concluded that the exterior sound level should not exceed 65 dB (A).

Often noise transmission through the floor and ceiling of a classroom does not present a problem either because the surfaces are solid and heavy, and therefore provide great noise reduction, or they lead to regions in which the noise levels are low. For example, a classroom on a concrete slab or over a storeroom would not receive significant noise through the floor. However, some of the walls often lead to noisy regions and contain windows and doors, and therefore they must be given special consideration.

Doors should be heavy and rigid, and should fit tightly in their frames in order to preserve the integrity of the wall. This is particularly true if student traffic is likely to pass the door while the class is in session. Doors in walls between classrooms should be provided only when it is absolutely necessary, and then extreme care must be taken to insure that they do not ruin an otherwise acoustically adequate wall. Windows and doors should be spaced as far as possible from those of adjacent classrooms, and they should be closed while classes are in session. If the doors and windows must be or are likely to be open during classes, they should not lead to an acoustically hard courtyard or corridor.

To insure that windows and doors can and will remain closed, classrooms for the deaf should be provided with adequate forced-air ventilation. This is required particularly in those classrooms that are relatively small and in which the classes are likely to remain in session over relatively long periods. Supply and return ducts for the forced air should be designed and acoustically treated to inhibit crosstalk between classrooms. It is likely that acoustical duct lining and duct silencers will be necessary. Fans or blowers in the classrooms should be used only if their noise levels are sufficiently low. Window air conditioners often produce noise levels of 40 to 55 dB (A) in the rooms into which they work, and, clearly, these units could not be used in classrooms for the deaf. Although exceptional situations may exist, it is generally unwise even to consider the use of window units.

Location of the Classrooms

The acoustical design of a classroom depends in part on the acoustical environment in which it is placed. Rooms in more noisy environments will require walls, doors, and windows with greater transmission loss, and consequently construction costs will be higher. Therefore, it is advantageous to locate the classroom within the school building so that these costs are minimized. A reasonable strategy toward this end is as follows:

1. Locate noisy rooms such as the gymnasium, auditorium, music room, and machine room as far as possible from the classrooms. Often the classrooms can be buffered from these noisy rooms by interposing other rooms such as offices, storerooms, laboratories, and corridors that can tolerate higher noise levels but usually contribute little of their own.
2. Do not locate doors of classrooms that lead into a common corridor directly opposite each other. If possible, the doors should be placed in pockets as shown in Figure 2. These doors are safe, because they swing into neither the classroom nor the corridor, and the pocket provides a tortuous path or sound trap for noises that ordinarily would pass through the door.
3. Corridors should be carpeted and, if possible, treated with ceiling absorption to abate corridor noise and to inhibit acoustical coupling between classrooms.
4. Windows of classrooms should neither face windows of another classroom nor a source of noise such as a playground, busy street, or highway.

Location of the School Building

As important as the location of a classroom within a school building is the location of the building with respect to the surrounding community. The building site must be selected with good classroom acoustics in mind. A little forethought can often keep building costs down and can eliminate many future headaches that will result from acoustical

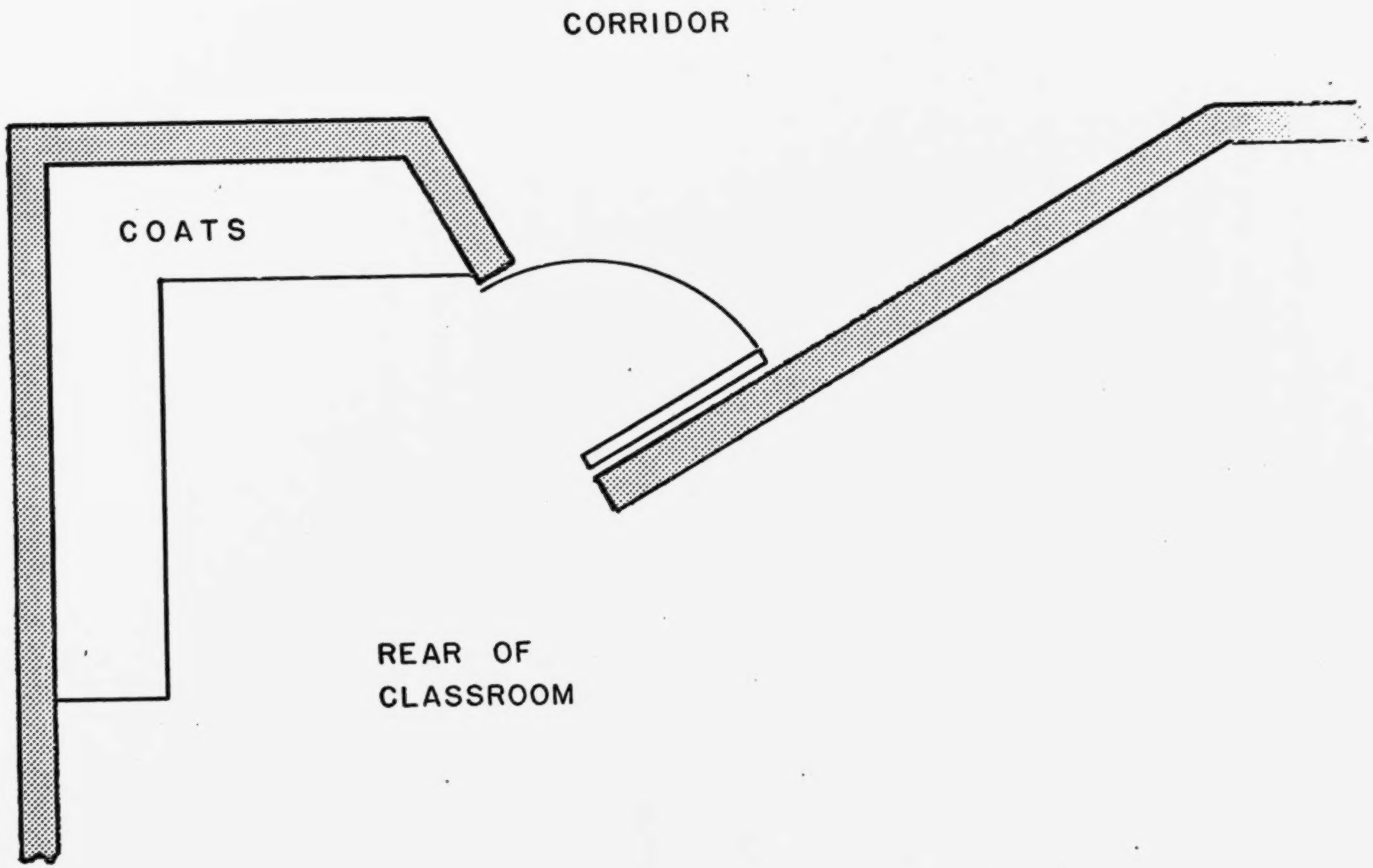
CORRIDOR
COATS
REAR OF
CLASSROOM

FIGURE 2 - EXAMPLE OF A POCKET DOOR

problems. The ambient noise level at the building site should not exceed 70 dB (A), and this level can be tolerated only if severe noise control procedures can be employed. For example, double glazed and tightly sealed windows may be required.

The school building should be located at least 300 feet, and preferably 500 feet, from main traffic arteries that allow trucks and motorcycles. The lower limit may be used if appropriate ordinances for traffic noise are strictly enforced; the upper limit must be used if no ordinances exist or if they are not enforced. The lower limit may also be used if other buildings or solid structures are located between the traffic and the school. After a quiet school site has been selected, meaningful ordinances should be enacted to regulate traffic and other noises in that area.

Summary

Proper acoustical design of classrooms for the deaf will insure high speech levels and low noise levels at the ears of the student. High speech levels are accomplished through proper reverberation in the classroom. Low noise levels result when a school is designed, located, and built using reliable noise control procedures.

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USE OF AMPLIFICATION IN EDUCATING DEAF CHILDREN

by

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He joined the staff of Central Institute for the Deaf in 1950 and was promoted to his present position in 1965. He has been published extensively in scientific journals and is author of the well-known textbook, "The Measurement of Hearing". In 1956 he won the Biennial Award of the Acoustic Society of America as the outstanding scientist under 35 years of age investigating problems in this field.

Dr. Hirsh has done research in many areas of speech and hearing, particularly in the way in which two ears interact toward slightly different sounds. He has investigated the way in which noise masks or obliterates the hearing of other sounds, particularly speech, the loss of sensitivity of hearing following exposure to noise, and related problems.

USE OF AMPLIFICATION IN EDUCATING DEAF CHILDREN

Almost all educators of the deaf agree that whatever residual hearing is demonstrable in a deaf child should be used maximally. The great differences that exist among the several philosophies of educating deaf children concern both the sense modality that will be used principally for the input of information and also the kind and amount of use that can be a goal for the residual hearing. Two facts appear to be quite clear. First, hearing, and more especially listening, are learned;[9] the discrimination among and recognition of sounds get built out of auditory experience. Second, severe hearing losses of more than 60 dB (ISO) in the low frequencies and more than 90 dB at frequencies of 1000Hz and above render all but the loudest environmental sounds and the sounds of speech completely inaudible unless they are artificially amplified.[4] Thus, the auditory experience that is part of the learning of normally-hearing children -- and that is essential in the learning of the hearing-impaired child -- must utilize amplified sound in all but the mildest cases of hearing impairment.

If amplified sound will be the auditory input for the deaf child, then we must design and even contrive the acoustic environments of such children in order to maximize the amplification of desired signals and minimize the amplification of undesired noise. In the following pages I would like to review several alternative systems for amplifying sound, each of which can be found in some school or training center, and point out advantages and disadvantages of each. These features depend intimately on the learning situation -- whether at home, in a nursery school or kindergarten, in a formal or traditional classroom, or in the modern work-study room. The kind of amplification also makes more or less critical some of the acoustical features of rooms and their surroundings already discussed by Dr. Niemoeller.

To illustrate the importance of what he and I are trying to point out, let me digress very briefly to report a recent, horrible example of what can happen when we forget one or another of these points. A rather famous school for the deaf was recently given a large parcel of land and considerable money to construct a new school building. The land, acquired by some well-intentioned benefactor, was just off the runway of one of our country's busiest airports. After all, what better use could be made of such noisy land than a school whose children couldn't hear anyway? That logical question might have been put by some one who never heard of auditory training, but now imagine the enormity of the problem of designing a school in which amplifiers would be used to bring speech and other signals to levels of audibility while jet aircraft are pouring in sound levels in excess of 100 dB! Those deaf children would certainly acquire auditory experience with aircraft noise. I am not sure whether or not the site will be changed, but if not, the architect will have to use quite a bit of massive concrete and many double sets of double-pane windows.

Systems of Amplification

All of the systems to be discussed have in common the following features: sound is picked up by one or more microphones and converted to electrical potentials; these signals are amplified through vacuum-tube or transistor circuits; the amplified signals are re-converted to sound through earphones, usually the midget type that connect to small plastic earmolds, shaped to conform exactly to a particular individual's ear canal and outer ear. The differences among them concern the number and disposition of the microphones as well as the portability, and thus, the generality of use in a variety of situations.

Single pick-up, group hearing aid. Among the oldest types of classroom installation is a kind of public-address system. A single microhone is held or worn by the teacher, and her speech is amplified and delivered to children's earphones (instead of to loud speakers as would be the case in the public-address system). A precursor to this system is seen, for example, in pictures of Dr. Max Goldstein,[1] founder of Central Institute, using a Simplex tube arrangement in which he spoke into a mouthpiece that was conncected by tubing to the ears of each child in a group. That was before vacuum tubes. Figure 1 shows the arrangement of a modern system. If the microphone is carried or worn by the teacher within about 6 inches of her mouth, the speech signal at the microphone has a sound pressure level (above 0.0002 microbar) of about 85 dB. With such a system, acoustical considerations for the room are not extremely important because reflections from the walls of her voice are too weak to be bothersome, relative to her 85 dB level, and none but the very poorest room locations would have noise levels even near the 85 dB level at the microphone.

Why not, then, use such a system that appears to be so well protected from variable acoustical environments? An acoustic gain of only 40 dB would be sufficient to bring the teacher's voice level to 125 dB

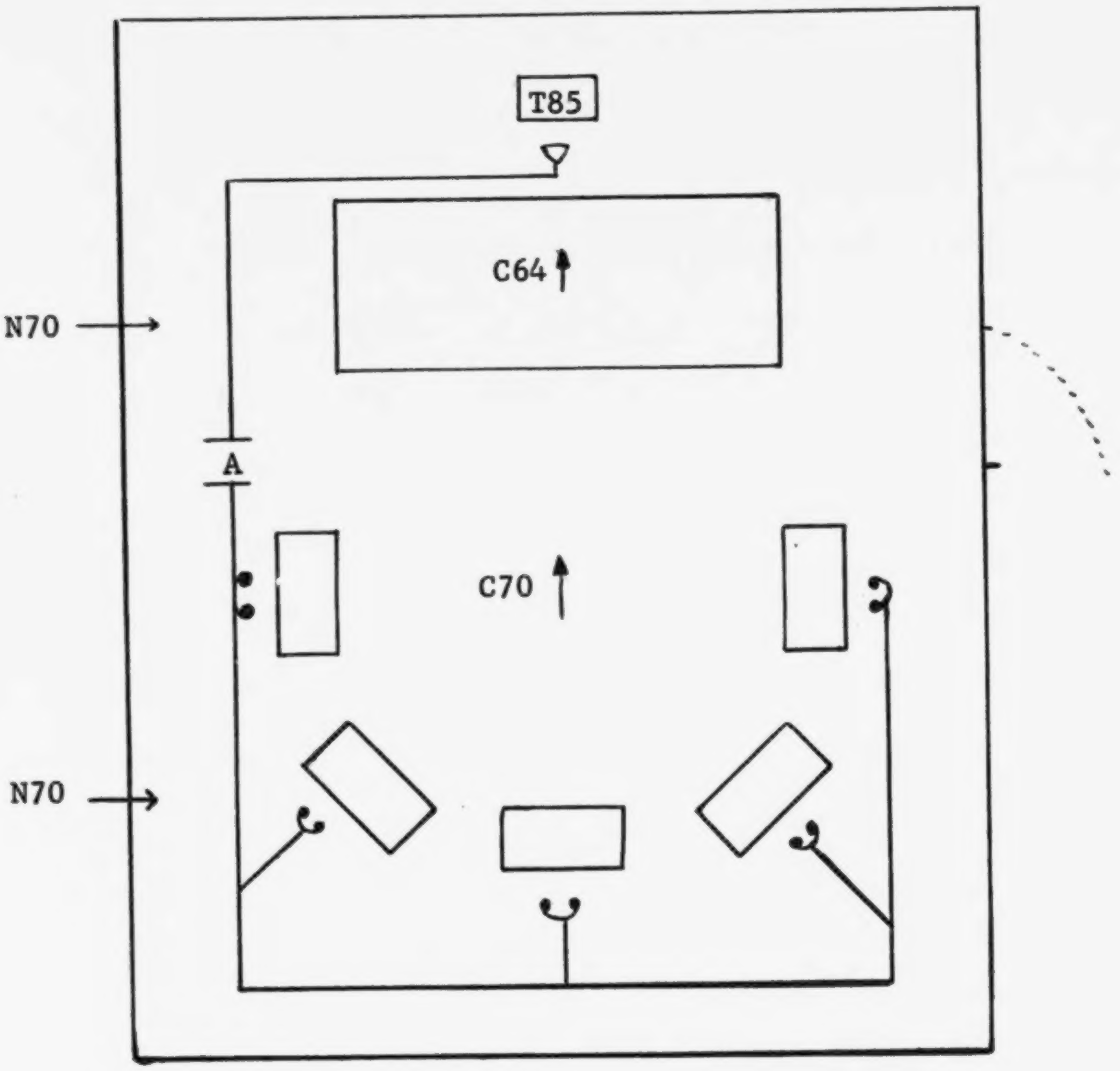

Figure 1. Diagram of a single-microphone group hearing aid. If the microphone is worn near the teacher's mouth, her voice level in the microphone may be about 85 dB, but the voice levels of the children will have decreased to about 64 dB before they reach the teacher's microphone, a level somewhat below that of the assumed noise background (windows open) of 70 dB.

in the ear canals of the students, this being within about 10 dB of the maximum that one would ever want to generate.

The chief disadvantage is that the teacher's voice is the only sound source available for suitable amplification. There are some systems of teaching where this might suffice, but most auditorily inclined teachers prefer also that the children hear their own voices. In this first system, the children's voices, at an average distance of about 2 meters would have levels at the teacher's microphone of only about 60 to 64 dB, that is about 20 dB less than teacher's voice.

Multiple pick-up, group hearing aid. To make the children's own voice levels more like those of the teacher we must move the microphone closer to the children. Sometimes one finds a compromise position for a single microphone, namely on a stand or suspended from the ceiling about halfway between teacher and students. At such a central position levels from all talkers will be about 70 dB. Consequently, the gain of the system must be increased by about 15 dB to yield the same levels in the ear canals, but also the background noise is amplified by the same increased amount and thus, the resulting signal-to-noise ratio is about 15 dB worse.

Ideally, we should place a microphone near each sound source that we want the students to hear, and at the same time keep all microphones away from sources that we do not want them to hear. Two alternatives are in current use. The first provides each child with his own microphone, usually on a short stand on his desk, but more recently on a head-carried boom like the ones used by telephone operators. The booms, while requiring a head-carrying structure most often provided by a large, over-the-ear type of phone, is an excellent pickup for voice that is insensitive to other sounds. The desk microphone, on the other hand, while less encumbering physically, also responds very well to such unwanted sounds as the pencil moving across the paper on the desk, or the moving of papers, or the snapping of notebook rings.

The second alternative removes the microphone from a boom distance of 3 inches or a desk-mike distance of about 1 foot to one of about 2 feet, between the student and a microphone on a floorstand -- often one microphone per two children. (See Figure 2). Student voice levels are down somewhat, desk noises are down considerably, and, if there is a carpet on the floor, foot noises are not bad either.

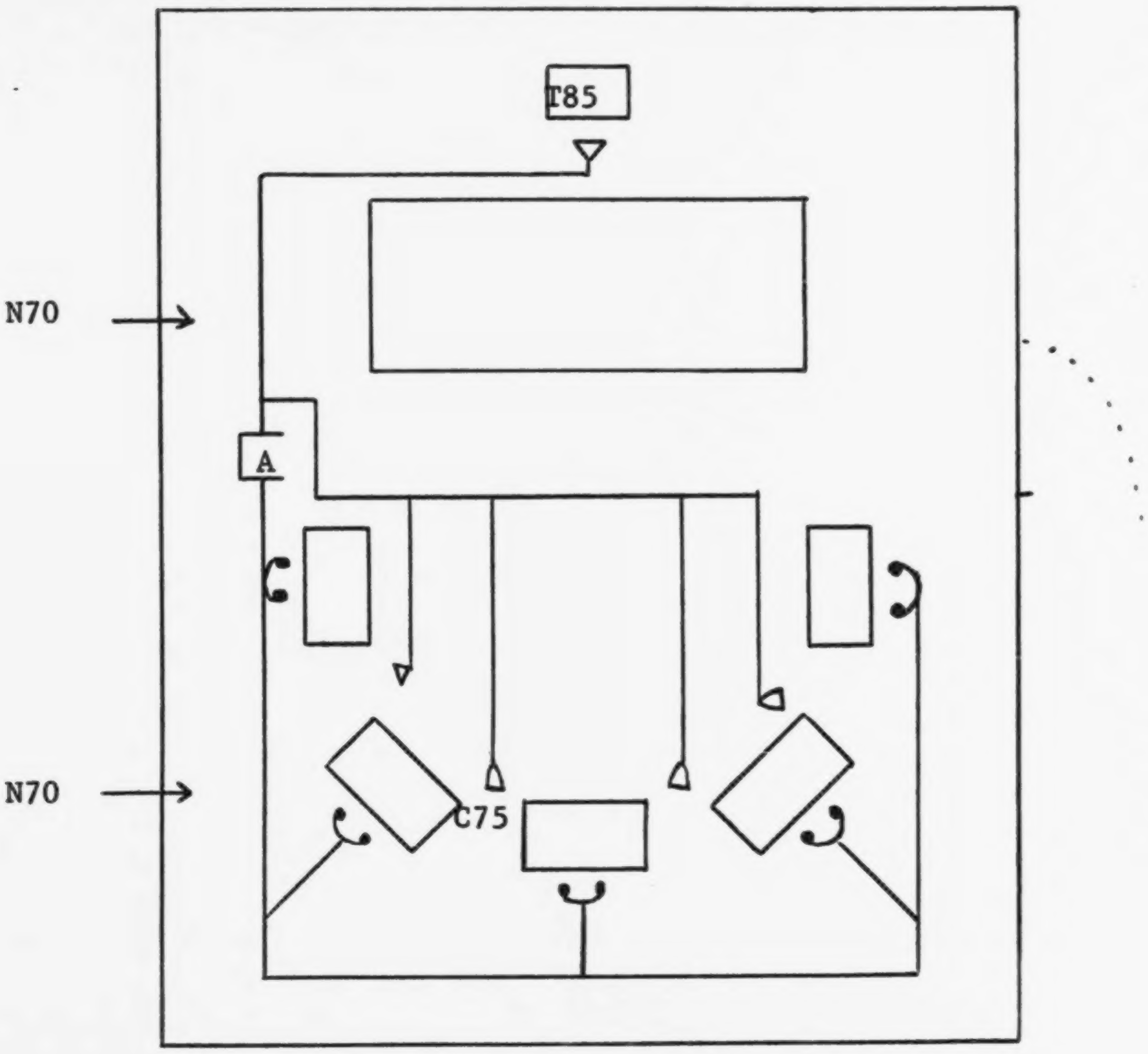

Figure 2. Group hearing aid with multiple microphone. Here the teacher's voice level is still high, and additional microphones have been installed on floor stands near the child (but not worn on their heads or chests) so that the children's voice levels may be about 75 dB, that is higher than the background noise.

In short, the need for amplification of children's voices in addition to the voice of the teacher is met by a wide range of multiple pick-up systems from those that provide a separate microphone for each voice source. By way of anticipating the next section on learning. situations let me remind you that the descriptions so far have concerned classroom systems.

Personal hearing aids. Especially since the development of the transistor, there has been remarkable change in the size and performance of wearable, personal hearing aids. The miniaturization, which we see evidenced in advertisements that show the whole hearing aid worn in the ear canal, however, has not very much to do with deaf children. The high gain required by severe hearing impairments still requires a relatively larger microphone-amplifier package, and, furthermore, avoidance of the squealing acoustic feedback for such high gain requires a physical separation of microphone and earphone.

Figure 3 shows the same classroom diagram, but now with no classroom group amplifier. Instead each student wears his own personal hearing aid. Let us review the levels of speech and noise sources. The teacher's voice level is still 70 dB or more at a distance of 1 meter, but the students' hearing-aid microphones are now more than 2 meters away. Teacher's voice level at those hearing aids is now 60-65 dB. If, as we hypothesized before, the noise levels are 70 dB in the room, the amplified teacher's voice will be below that of the noise. Of course, the student's own voice level is now stronger at the microphone since the hearing-aid usually is worn on the chest, perhaps 8 inches from the lips. Distant signals, however, like the teacher's voice, the voices of other students, the loudspeakers of moving-picture projectors, etc., are all enmeshed in the unwanted noises of the corridor, the playground and the classroom itself. A classroon in which all students carry

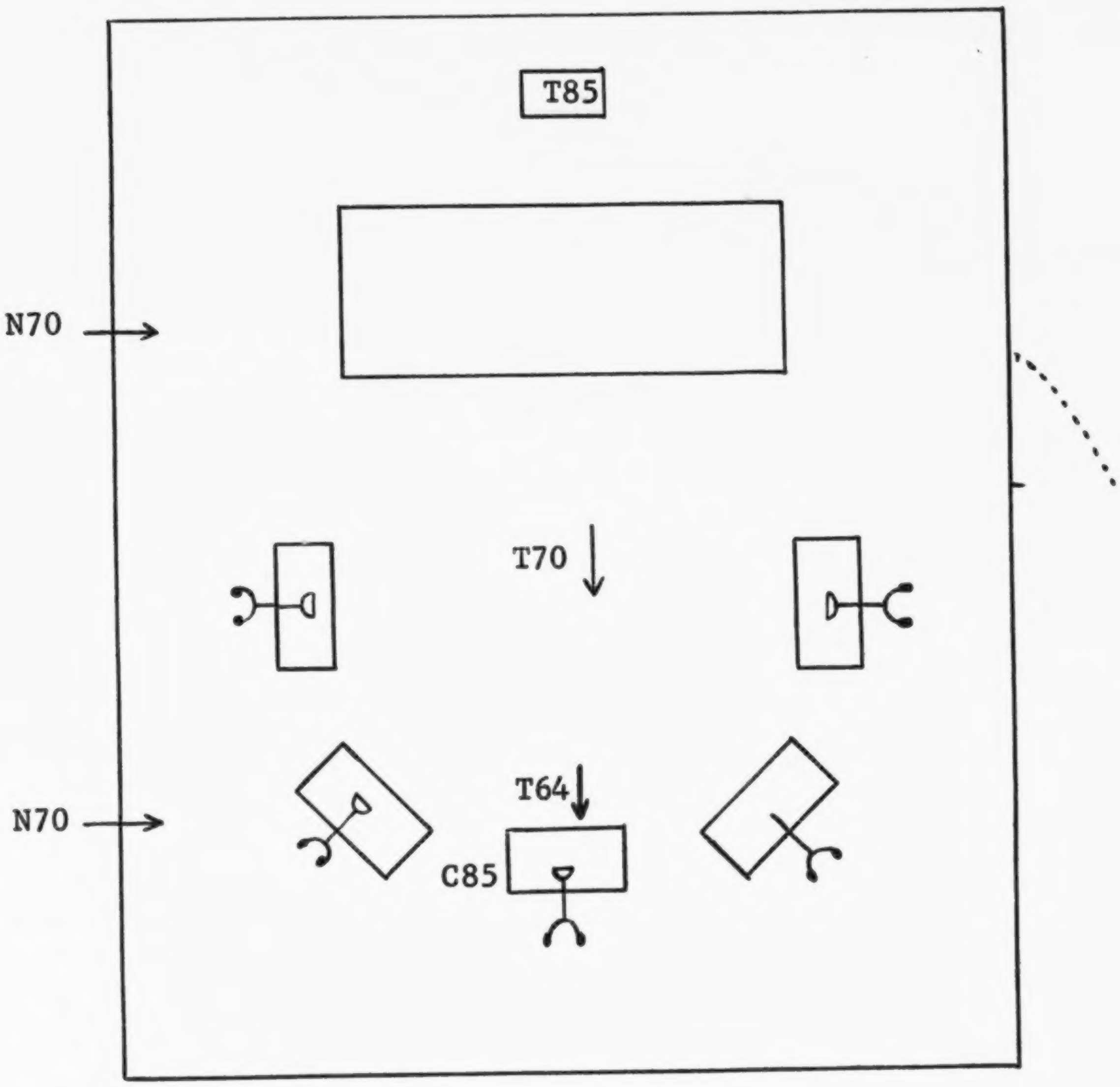

Figure 3. Classroom with personal hearing aids. In this case while the teacher's voice level is 85 dB near her mouth it has fallen to 64 dB by the time it reaches one of the microphones of a personal hearing aid on the child. Thus as it enters that microphone it is weaker than the ambient noise level. The child's own voice level is, on the other hand, high for his own microphone.

personal hearing aids places the most stringent requirements on acoustical design.

Personal-group combinations. The general principle that emerges so far is that hearing aids of any type, large or small, will function best when signal sources are close to the microphone.[6] The farther away the sources must be, the more must non-signal sources be excluded from the room or absorbed in the room. Now since the single-microphone system described first favors teacher's voice and excludes or reduces the effect of all other sources, and since the personal hearing aid favors the student's own voice, might we not combine the best facets of both? There have been many such combinations, the most widely used at present being the induction-loop system. (See Figure 4). The loop is literally a single or multiple loop of wire, usually long enough to

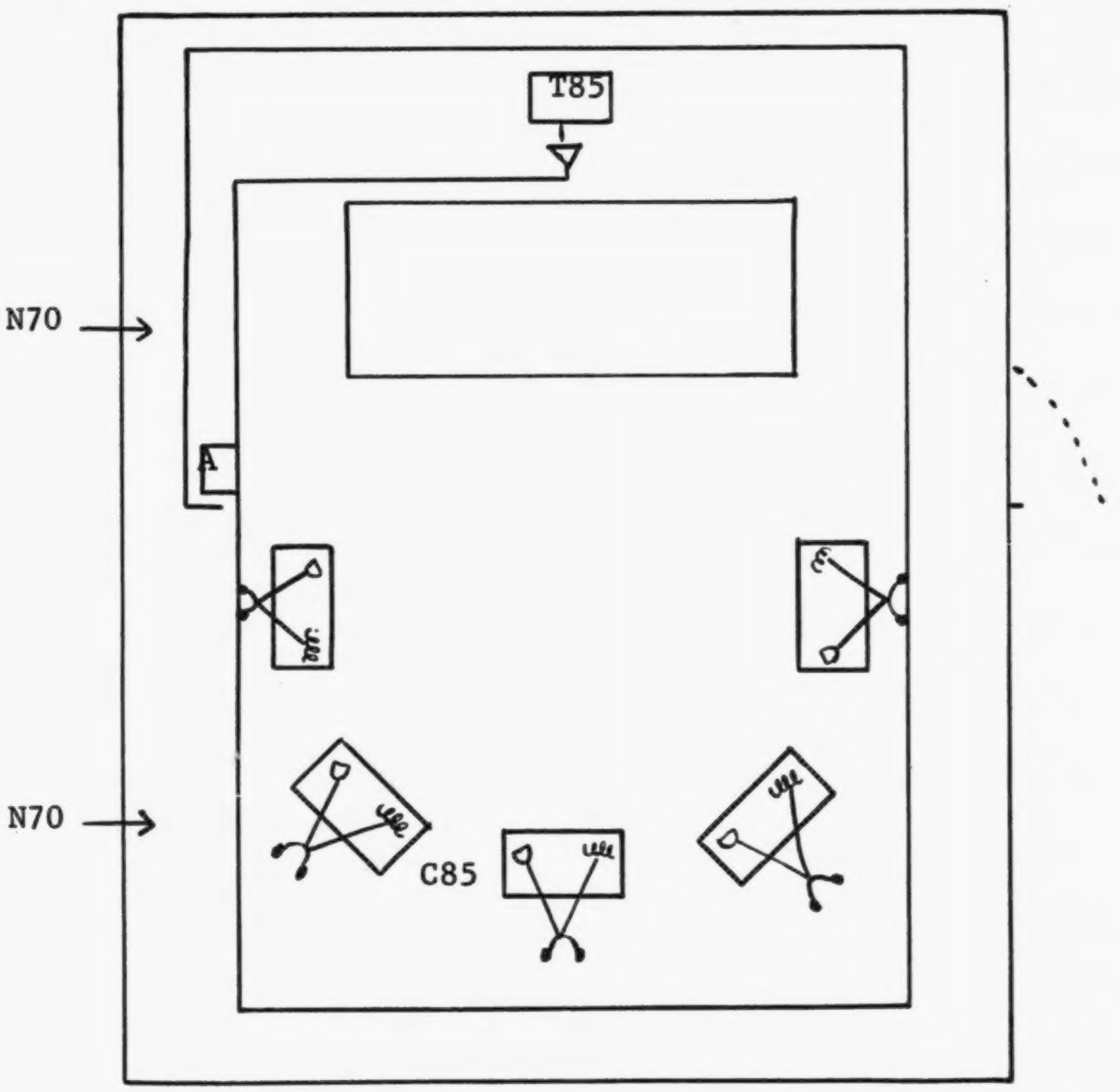

Figure 4. Combination of group hearing aid and personal hearing aids. This diagram shows one possible combination, that of an induction loop fed by an amplifier which in turn is fed by the microphone worn near the teacher's mouth. The output of the loop is picked up by coils in the personal hearing aids. In addition, the microphone of the personal aid receives a high voice level from the child who wears it.

encircle the floor perimeter, with both ends of the loop comprising the terminal load on a group-hearing aid amplifier. The output of the amplifier no longer actuates earphones, but rather creates fluctuations in the magnetic fields around the wire. These fluctuations can be picked up by such inductive coils as are installed in personal hearing aids for use with telephones. Such hearing aids in the past have had a two-position switch for the input circuit: either the local microphone or the telephone pick-up coil. When hearing aids were employed in this loop system, all the students had to put their input switches on the telephone-coil position in order to hear the output of the amplifier which in most cases was putting out the voice of the teacher from a single microphone, but they could not then hear their own voices. More recently, a three-position switch has been installed in several of these hearing aids, the third position being a combination one that permits the listener to receive simultaneously in his hearing aid outputs of the telephone coil and the local microphone. Thus, at present, users of such systems can hear their own voices picked up through the local microphone and the teacher's voice picked up by the group microphone near her mouth.

Furthermore, even the multiple-pickup system can feed the loop so that floor or desk microphones from other students can bring their voices into the group system. Thus the child can hear his classmates as well as the teacher through his coil pickup. At the moment such a combination appears to enhance most of the advantages discussed above with respect to different microphone placements and at the same time seems to resist picking up too much ambient room noise (except in the case of multiple pick-up systems where some of that noise enters the floor or desk microphones).

You may ask why such systems are not more widely used than they are and the answer is quite simple. The magnetic fields that surround such loops are not restricted to a single room, and thus can be picked up by telephone coils in the hearing aids of children in the next room and indeed in any room within distances of approximately 20 feet. Thus, one has no hesitation about recommending the loop system in a public school for normally hearing children where there are only one or two classes for teaching hearing-impaired children, especially when even two rooms can be very widely separated. On the other hand, in a school for the deaf where ten or fifteen contiguous rooms (vertically or horizontally) all have loops, the resulting room-to-room confusion would not be very helpful in any program of auditory training. Radio-frequency links, as opposed to direct magnetic, have been designed to overcome this problem, but unfortunately do not as yet permit the child to incorporate his own personal hearing aid in the system.

Learning-Listening Situations

It is not very difficult to list, as we have above, the various combinations of microphones, amplifiers, and output circuits that have been used or have been suggested for use in the education of deaf children. We have suggested some advantages and disadvantages that are associated with one or the other kind of system but now we must further complicate the picture by suggesting that the relative weights of such advantages or disadvantages would differ depending upon the age of the child and the goal of the educational program.

Learning to Hear. Although we have spoken mostly of classrooms so far, I propose to consider these situational differences chronologically.

In recent years, as you know, there has been an increased interest in detecting deaf babies at a very early age and beginning their training even in the first year where possible.[2,8,9] Concern for these babies and pre-school youngsters has not been expressed so much by official schools for the deaf or state educational administrations, but more by centers that specialize in audiological services or in departments that have extended the scope of schools for the deaf to include these very young ones.

Although our principal use for amplification later on in classrooms will be for the monitoring of speech production and the perception of speech through whatever residual hearing there is, for the moment we emphasize conditions necessary for learning to hear. This is a very important point that is not always obvious. With some practical results to guide us, we must know that the big push in the area of infant training has come by deduction from other areas. Two principal ones come to mind. Fist, we recall about two decades of research on the influence of rearing animals in darkness in their first months of life.[7] It does indeed appear to be the case that when such dark-rearing is accomplished, animals then brought into the light are and remain functionally blind so far as even gross visual discrimination is concerned. Furthermore, it has been observed that simple light stimulation by, for example, unpatterned homogeneous light is insufficient to build the connections in the visual system during the early stages of maturation. We fear that similar ends might befall the deaf child whose residual hearing is left unstimulated because environmental sounds have not been amplified and because he has not had occasion to respond to them or deal with them in other ways. A second, more recent source for analogizing, comes from the findings of persons who have gone to work in culturally-deprived areas of our large cities.[10] Here it has been noted that absence of stimulation and in particular absence of the opportunity to exchange speech with other persons results in a language retardation that is difficult to overcome except under the best learning situations. Language does indeed appear to require communication even at rudimentary levels for its natural development. We cannot merely measure thresholds of audibility with an audiometer and then assume that those thresholds will mediate auditory behavior like that of an adult whose hearing was lost through accident or disease. Hearing sensitivity must be exploited and stimulated in order that the child learns to hear; and if he does not learn in a natural way even with amplified sound then he must be taught to hear.

The circumstances for the best kind of natural learning are probably not those described above that correspond to the traditional classroom where a teacher's position is maintained as a focal point relative to a semi-circle of students. Babies do not take kindly to this type of social situation. Instead it appears more likely that learning to hear would and should take place in the child's own nursery, in the family living room, in the bathroom, the kitchen and backyard. In fact several schools have set up homelike environments where such learning can take place under the supervision of a professional teacher.[8]

How can we relate such favorable early learning conditions to our previous discussion of amplification systems and the proximity of microphones to desired signal sources? For an hour spent on the floor of a carpeted living room with toys, mother, teacher, and playmates, what are the desired signal sources? The situation is more complicated than the classroom where we said that the desired signal source was first the voice of the teacher and second the voice of the student. Here it is a combination of the voices of baby, playmates, mother, teacher, and also the sounds made by the toys, the television, and the pets. In the process of learning to hear, the child need not, and probably should not, be restricted only to speech sounds. Thus the signal sources are multiple and they are not stationary. It seems pretty clear that the ubiquity of the personal hearing aid recommends it for use here. Those sounds enumerated just above are complicated enough, but they are often accompanied by other sounds with which the child does not enter into any kind of an experience relation. Here I have reference, of course, to extraneous sounds from outside--machines, footsteps, in short any source to which his attention is not to be directed. In this situation, acoustical design, for exclusion of external sources and absorption or reduction of internal ones that are of no consequence, is extremely important.

At a later stage of development, for example in a nursery school, this kind of situation becomes somewhat more structured. The teacher is more actively inserting her own speech model into the auditory environment of the child. In such a situation a combination system like the loop does appear to be advisable for two reasons. In the first place, the teacher's voice can be made a kind of figure upon a background of other sounds by virture of its being broadcast through the loop system, perhaps at even a stronger level than those falling upon the microphone of the child's hearing aid. The second reason, which contrasts the loop system with that of a traditional classroom amplifier is, of course, that these babies, and even older three-year-olds in the nursery school, do not take well to being tethered to permanent stations by the cords that lead from their earphones to the connections of the group hearing aid.

Classroom teaching. For use in the classroom there is some argument, with good and bad on both sides, involving the group hearing aid, fed from the teacher's microphone and some floor and desk microphones near the students, and the personal hearing aid, fed by loop or other set system that allows the teacher to come closer to the pick-up than would be the case if children simply wore portable hearing aids. It is probably true that one sacrifices ease of maintenance, some acoustical quality, and some signal-to-noise ratio when he moves from the traditional group hearing aid to any of the combination systems involving personal hearing aids. One would hesitate to give up these acoustical characteristics if he could be sure that the children were old enough to stay either at their desks or at a limited radius throughout the school day or at least during the teaching hours.

One sees recently, however, both in the elementary and the high schools, teaching rooms that appear to be combinations of what were laboratories, workrooms, and classrooms a generation ago. I presume that the evidence favoring these new arrangements is available to all of you and that, therefore, their use will continue to increase. If it is to penetrate schools for the deaf, as well, then new problems are thrust upon the designers of amplification systems that require students to be attached to fixed locations. As the school room space becomes more flexible the likelihood that traditional group amplifiers will continue to be used is reduced.

There is an additional advantage to loop systems in the schools (if only we could use them in classrooms that were next to each other) and that is that the same personal hearing aid that the student uses to tune in his teacher on the telephone pick-up is used by him outside the classroom for other kinds of listening. I am sure that there will be other more sophisticated systems developed in the near future that will have accomplished a similar goal to that of the induction loop but that can also be used in numbers sufficient for all the rooms in a given school.

Summary

Hearing-aid systems vary widely not only in overall quality but also in such essential features as the number of pick-up elements (microphones) and the way in which the output of the amplifier is delivered to the ear of the student. We have shown that the best acoustical performance is obtained when the microphone of any such system is close to the source that is desired. This simple rule, however, becomes complicated as soon as the educator tells us that the student should hear not only the voice of his teacher,but also his own voice,and finally, the voices of his classmates. The rule is further complicated in those teaching situations where young babies are being taught to hear, even before the more formal situations with speech, language, and the elementary school curricula are the focus of interest. Personal hearing aids afford a maximum of flexibility for the children but also impose a maximum of acoustical requirements on the room, floor, and other features of the surroundings. Combinations of these advantages in flexibility of a personal aid, both in and out of the classroom, with the clear and near source that can be amplified without noise in a traditional group system (for example, the loop induction one) are probably the best compromises available today. Further technical development is required, however, in order to permit the use of such principles of radiating electromagnetic energy to operate in two or more proximate classrooms.

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THE WORKSHOP CLASSROOM

FURNISHINGS IN THE LEARNING MODULE

by

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THE WORKSHOP CLASSROOM

FURNISHINGS IN THE LEARNING MODULE

Education is an individual quest for an understanding and mastery of reality. It is the process by which a child builds a coherent picture of his internal world and the external world. Each child begins to develop patterns of learning at birth. By the age of three, when he enters nursery school, many of these patterns have been firmly established. A school's part of the educative process is to establish classrooms and relationships in classrooms in order that many children can carry on their work of educating themselves most effectively.

The internal environment of a child, his self-image, his expectations, and his feelings have been previously shaped by both his internal reality (genetic differences and his unconscious) and external experience. Yet the school must work effectively with these factors if skills and information are to be an integrated part of the child's total education. The environment for education must let a child meet and test as much physical and social reality as he can cope with. A teacher must know the child and the group of children well enough to make the decisions that will build the social and physical environment of the classroom. Though no teacher has time enough or can know enough to make each moment-by-moment or incident-by-incident decision as deliberately as the foregoing might indicate, one must realize that the teacher, too, is involved in his own education. He has a set of experiences, intuitions, abstract values, and emotions that affect his interactions with the child.

The child is as much a part of the teacher's environment as the teacher is part of the child's. It is only through a wide range of shared experiences and activities, and with ample time, that people become known to each other.

The objects in the classroom must be there because the teacher has chosen them in his professional response to the needs of the children in the class. They are there to provide opportunities to widen the sphere of physical and social experience.

Craig states: "Much of the child's learning about his environment may be associated with what the adult usually calls 'play'. But much of this so-called 'play' is a learning process through which a child learns to manage himself in a universe of matter and energy."[1]

Play is the universal human educative mode. It is through play that we test ourselves, others, and materials so that we can build our individual but integrated view of external and internal reality. Play as part of the school day allows for the buildup of enough experiences so that a child's unique set of capabilities has a chance to keep him absorbed in his own education. According to Dewey:

> "What avail is it to win prescribed amounts of information about geography and history, to win ability to read and write, if in the process the individual loses his own soul: loses his appreciation of things worthwhile, of values to which these things are relative; if he loses desire to apply

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[1] Gerald S. Craig, Science for the Elementary School Teacher (Boston: Ginn and Co., 1958), p. 3.

> the ability to extract meaning from his future experiences as they occur."[2]

Though no man can know reality completely, he can spend his life building up a set of experiences that brings him a more complete view. It is this continuous on-going process that is education.

An educational program for children must be part of the environment, atmosphere, and attitude that a faculty builds. Children learn about things by the way they are treated. A teacher who is able to wonder about moving dust particles in the sunlight and can respond to the feelings of a child is teaching aspects of social and physical reality.

"How do we fit the facts and skills into our program of education for children?" This is the proper question, not a schedule that has planned out everything in advance. A program that attempts to help children keep involved in their own education must be built for both children and adults to share interests, to communicate with each other, and to trust each other. A leisurely pace comes from the secure knowledge of the adults that there is no rush. In the years of childhood, certainly until the child is past twelve, drill discipline and facts should be subordinate to involvement, relationship and fun.

Education of the Deaf

Because of the nature of the problem of teaching deaf children language and speech, forces are often present in a classroom or school that unintentionally limit the range of educational experiences of the deaf child. The countless hours spent by the deaf child sitting in groups and drilling on language and speech skills tend to foster a kind of passivity in the child. This passivity runs counter to the need of a child to explore his world. The author recognizes the profound importance of early acquisition of speech and language skills and hopes simply to assert the importance of moving toward acquiring these basic skills in balance with a program that stresses active inquiry by deaf children. Although there is no doubt that during a school day there will be need for individual or small group speech or language lessons, there is the duel hope that these lessons will be related to such activities as the building of a block village and that the children might be free to work on the block village while one child is getting the special help he needs.

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[2] John Dewey, *Experience and Education* (New York: The Macmillan Company, 1959), p. 50.

Production is a basic theme for learning in school. Only when a class is a workshop where tools and raw materials are organized and available can a child learn to make the decisions that he must make to build and explore the things that bring the success that builds his sense of competency. Learning to plan, organize, communicate, work with others are underpinnings that make the skills he will learn truly useful. A classroom organized as a workshop will be a hive of activity but the school and the community will be available to student workers to gather information, ideas and questions that will be brought back to the smaller community of the classroom as food for thought, discussion and production of things, plays and books.

A teacher will use the workshop classroom to develop specific materials for individuals and groups of children as their need arises. The teacher is not limited by a fixed curriculum but rather the principal, working with the faculty, parents and community, acts to increase the range of ideas, materials and methods that will expand the range of expectancies of what learning in school can be.

Learning to read and compute and speak will grow naturally, unevenly, uniquely for each child. Uniform expectancies reduce learning to a low and dangerously dull level. We need not fear that a child will choose to gourge himself only on painting, rather we should fear that a child has found no area that he can fully commit his constructive impulses. When a child knows he has real areas of competencies he will risk more trying to succeed in new fields. The calm teacher will work to structure the attempt to manageable tasks that both challenge and provide a real success.

Children come in all kinds with all levels of competencies, expectations and experiences. Some children will take this productive self-starting workshop classroom easily while others will need to be brought toward this kind of autonomy slowly in more structured steps. Yet there is only one goal for every child in his early school years, the confident, happy, autonomous learner.

The idealized workshop classroom for either deaf or hearing children, or better yet where one or two deaf children are supported by itinerant teachers in a school for hearing, should be made of these elements: the room, the materials, and the teacher.

The room should be made as a series of organically laid out work spaces that makes use of every physical feature in it. In the quiet place near the window, a reading and writing area where children can quietly sit and think, write and read. A cooking area, with a refrigerator and stove, a food preparation place where children can work at planning and cooking their own meals. A large crafts area where children can work with wood, metal, plastics and cardboard to build large things. A fine crafts area where children can sew, weave, paint and work in ceramics. A dramatics area where children can put on their own productions. A printing area where children can print their own poetry, stories and books. A carpeted discussion area where groups can comfortably sit and talk about the problems and decisions necessary for the class to function.

This classroom will have to be worked out in close cooperation between teacher and architect to make it possible to live comfortably with the tremendous amount of activity that this room should be supporting. Areas will have to developed that are quiet, isolated, that are formal, that are informal. Most important, the teacher and the children must be able to manage the classroom and keep it non-cluttered while the production and work is carried on.

Materials: This room will need to have developed in it storage facilities for all the tools and raw material that will be necessary. A new kind of budgeting approach must be developed to support the different kinds of expenditures that this workshop classroom will incur.

The teacher: The workshop classroom is dependent upon a teacher who has the capacity to handle all of the activity while personalizing for each individual child the structure necessary for that child's learning to go forward. This teacher must be vigorous and learning in his own right. He must be big enough to find the help that he will need. The various skills in these crafts and the skill in helping individual children to learn and develop at their own pace will necessitate his finding other adults and children with these skills that will help both himself and the child he is working with.

The author has become convinced in the process of working on the problems involved in providing science education for deaf and hearing children that the classroom atmosphere and the degree of opportunity that children have to explore physical and social reality is critical. The atmosphere in the classroom for the deaf must be relaxed and flexible. It must provide children with a secure enough base so that they will be able to become involved in the process of their own education from the earliest time possible. In the education of the deaf, where the process is so difficult, the teacher desperately needs the child reaching out toward him as he tries to reach the child. If he can capture and hold the child's interest and imagination and provide situations that are inherently interesting to any child, then he has a valuable ally with whom to begin working.

Because of the imprecision of communication, a deaf child is often unable to follow directions. The deaf child in an oral school must be constantly assisted in his development toward intelligible speech. The inability of this child to do things correctly the first, second, or third time he is directed leads to a feeling of inadequacy and a negative picture of himself. Therefore, there can be no more important area in the education of the deaf than the building of an atmosphere that allows for honest success in the manipulating and understanding of his environment.

The confident deaf child can better accept the necessary emphasis on speech and language development if he is moving ahead in his struggle to obtain answers for himself. Corrections in the pronunciation of words that he has worked to understand are less painful to him.

Education for the deaf is the vehicle for transporting fragmentary and isolated impressions of the world into an ordered state. A workshop classroom can provide many of the skills needed for the process. Deaf children can build their language and conceptual awareness by investigations into biological and physical systems. Measuring, recording, speculating, and interpreting results are skills that are actively called upon in this kind of program. The same skills will be called for in the daily activities of these deaf children throughout their lives.

The major role of the teacher of the deaf is a correlative one. He helps the child to become involved with a study, to examine the situation more closely, to remember what he observes, and to plan further steps. Hopefully, as the teacher plans and executes the program, he will use the cues and signals emanating from the children to build upon the avenues of genuine interest among them and thus gain active student participation.

In essence, education of deaf children is a struggle to develop language. Language has the equally important, twin roles of fostering thought and aiding communication. In addition to isolating a person from his fellow, communication difficulties will cut him off from his own thoughts.

From the beginning, a deaf child receives impressions in ways different from a hearing child. A deaf child's view of the world around him will tend toward a less secure picture than that of his hearing peer. Talking generally about children, Piaget reports:

> "With regard to the intercoordination of schemata, that

> of sight and hearing may be mentioned. From the second month of life and the beginning of the third, the child tries to look at objects he hears, thus revealing the relationship he is establishing between certain sounds and certain visual pictures. It is clear that such coordination endows sensory pictures with a greater degree of solidity than when they are perceived through a single kind of schemata: the fact of expecting to see something instills in the subject who listens to a sound a tendency to consider the visual image as existing before the perception. So also every intersensory coordination (between sucking and prehension, prehension and sight, etc.) contributes to arousing the anticipations which are assurances of the solidity and coherence of the external world."[3]

The task of providing the needed vocabulary and context that will lead to clarity of thought and expression calls for tremendous efforts by both the deaf student and his teacher. A deaf child lacks sufficient repetitions and organizational categories as he attempts to use language. The hearing child, in contrast, is flooded with the elements of language.

Lewis says about the hearing child:

> "Gradually he comes to adopt our ways of speech, and with them something of our ways of thought. He learns to classify things as we classify them, to limit the meanings

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[3] Jean Piaget, The Construction of Reality in the Child (New York: Basic Books, Inc., 1954), pp. 7-8.

> of some words, and to extend the meanings of others. And as he learns to use words as we use them, he learns to perceive the world as we perceive it. Language becomes for him, not only the chief instrument of communication with other people but also the most powerful means of communicating with himself. He develops, with our aid, a system of internal speech by means of which he is able, with increasing accuracy, to understand and deal with things here and now, to recall the past, to imagine, to anticipate the future, and to reason."[4]

The Scylla and Charybdis of education for the deaf is a difficult passage between the rocks of language in a vacuum and the demons of activities that do not seize upon opportunities to develop language. We can agree with Avery's assertion: ". . .This language element must be given priority over any other in the training of deaf children for it is not only the objective of their education but also the means."[5] However, the present writer suggests that it is possible to become so preoccupied with language that the children themselves lose interest in learning and fail to develop a self-esteem that can only develop if they are first led to inquire and then helped to find and use the language that their inquiry makes necessary. Fusfeld made a plea in 1946 that is just as timely today:

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[4] M. M. Lewis, How Children Learn to Speak (New York: Basic Books, Inc., 1959), pp. 139-140.

[5] Charlotte B. Avery, "The Deaf," in William M. Cruickshank and G. Orville Johnson, eds, Education of Exceptional Children and Youth (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958), p. 372.

1. Ease up on the ritual that fixates the course of study.
2. Worship less ardently the cause of drill and review, and so help release the curriculum from the strait jacket in which we have unknowingly imprisoned it.[6]

There is a natural tendency of all teachers in all subjects to explain things. If the first explanation fails, we tend to use more words to get the point across. Hearing children learn to accept this. Deaf children can only be reduced in their own esteem and lapse into further passivity, if they must spend most of their efforts in deceiving their teacher into believing that they comprehend. Doctor illustrated this tendency in this way: " . . .I believe that as teachers of the deaf we have a tendency to give up finally and tell pupils the answers. I know I do. And sometimes by the time I finally explain the meaning of all the words in a paragraph, either the bell rings or I have forgotten the main points in the paragraph myself."[7]

Education for the deaf must teach language primarily as the natural outcome of the direct experiences and questions of a child. The workshop classroom can be used as a type of balance in a curriculum since its main efforts can legitimately be directed toward having the child tell the teacher. This approach to a deaf child's learning can be a way of reminding teachers that they must take extreme pains to nurture a deaf child's curiosity. If we help deaf children to become more aggressive about knowing and finding out, then we have a valuable ally in the tremendous struggle to educate the deaf child. Surely we need all the help we can get. The deaf child's involvement in his own education is in fact the only source of full-time effort that we have for each child. If we fail to make a deaf child a partner in his own education, we are probably losing the battle from the start.

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[6] Irving S. Fusfeld, "The Curriculum--Purposes and Otherwise," Volta Review XLVIII (November 1946), 691.

[7] P. V. Doctor, "On Teaching the Abstract to the Deaf," Volta Review, LII (February 1956), 549.

We have a very few early years when deaf children truly remain open and curious. Most deaf adolescents have already closed the doors. They no longer seek answers. They wait, instead, to be told.

An eighteen-year-old girl, Pia Luisi, about to graduate from a high school for the deaf, wrote the following when the author asked her to discuss some of the problems she felt the deaf have in learning about science:

> "Most deaf people I know are not aware of what life means to them and what is truth around them. They are not interested in learning but some of them do. They have a hard time to think and figure out or they haven't learned the art of thinking or create thinking--they depend on others to think for them. Thinking may be most difficult for them. Usually, they are afraid to ask or give any answer. Actually, they are not awakened about life.
>
> They don't like to learn many long and scientific words because they think the words are unnecessary to learn.
>
> They don't know they have to struggle all the time to

understand life, books, nature, and environment. Since life will never be easy, they have to struggle no matter what. Most of them don't look for the truth about everything--they just take for granted without stopping to think and discriminate."

LIGHTING IN THE LEARNING MODULE

by

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Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

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He belongs to numerous organizations in the field of optics and vision, and he has received several awards and citations in his chosen field of study.

Prior to joining the faculty of Ohio State, Dr. Blackwell held a similar position at the University of Michigan. Before that he was connected with the National Defense Research Committee and with the Polaroid Corporation.

LIGHTING IN THE LEARNING MODULE

Introduction

Instructional facilities must be designed to provide the variety of environmental conditions required for the educational purposes at hand. Optimal environmental conditions to satisfy different aspects of the human requirements for learning will likely place conflicting or contradictory requirements on facilities design. Thus, a specialist, such as I, in one aspect of environmental factors cannot recommend specific designs for instructional facilities without running the risk of over-emphasis. Rather, each of us must be content with describing the general human requirements for learning related to the aspect of environmental design with which we are especially familiar, leaving to the final "architect" of the learning module the application of these principles, together with the similar specific principles of design, to the creation of an optimal integrated design.

In the learning module, lighting has the principle purpose of providing the visual system of the learner with the conditions for extracting the information from the environment necessary for operation of the learning process. The visual modality is of the greatest importance to any learner. It is obviously of paramount significance to the deaf whose use of the auditory modality is so restricted. So far as our knowledge goes, the general principles which govern the operation of the visual sense in the deaf are the same as those for learners possessed of normal hearing. Thus, it would seem that I can serve the purposes of this symposium best by summarizing the state of our knowledge concerning the relations between the physical aspects of illumination and lighting, and related aspects of function of the visual system of the learner.

Information Extraction and Lighting Parameters

As noted above, lighting in the learning module is intended to facilitate information extraction. How do aspects of lighting influence the efficiency of information extraction?

It is obvious to anyone who has tried to find his way around items of furniture in a dark room to the light switch, and who has subsequently found it and flooded the room with light, that the presence of light has a profound effect upon the information we may obtain from our environment. To a less obvious extent, we have perhaps all appreciated that the amount of light determines at least crudely the degree of detail we may discover about the environment as when we take a difficult visual task to the window in order that we may see it better even though we are in a rather "well-lighted" room. These experiences convince us, perhaps without our thinking about it, that "more light provides better sight". Of course, if we are comparing day and night, or even outdoor light levels with interior lighting levels, the differences in the amount of light are enormous and it may seem obvious that we do see better with more light. The application of a general principle based upon observation of the effects of very large differences in light intensity to cases involving very small differences in light intensity may quickly lead us to error, however.

The fallacy of the principle that more light always produces better sight may be illustrated by two examples from common experience. First, most people don sunglasses whenever the level of outdoor light approaches nature's extremes encountered either in the desert on a summer's day or on a ski slope in the winter. Ideal sunglasses alter nothing about the scene except the level of light intensity. Most users of sunglasses would claim "better sight" with less light in this case. Secondly, the child studying at home at night may often be forced to use a localized source of light such as a desk lamp which may be located in such a position as to produce a massive light veil over the printed page which makes vision nearly impossible. If there is even a modest quantity of general illumination in the room, the student may well turn off the lamp and reduce the illumination intensity in order to see better. Again, it is clear that less light can produce better sight.

The contradictions implied by these admittedly extreme examples force us to analyze rather carefully precisely what the physical aspects of lighting have to do with the process of seeing. Fortunately, the past 25 years have brought the state of our knowledge of this subject to a comparatively advanced level of sophistication.

In order to make progress with this subject, laboratory experiments have had to be conducted in which the variables of the lighted environments were systematically studied in isolation. For example, literally millions of observations have been made in recent years in a laboratory set-up (Reference 1) in which the luminance (brightness) of a luminous environment was systematically altered in amount while all other aspects of the environments were maintained unchanged. The laboratory environment is shown in Figure 1. It consists of a large lighted cube. The observers look at a screen which constitutes one wall of the cube which

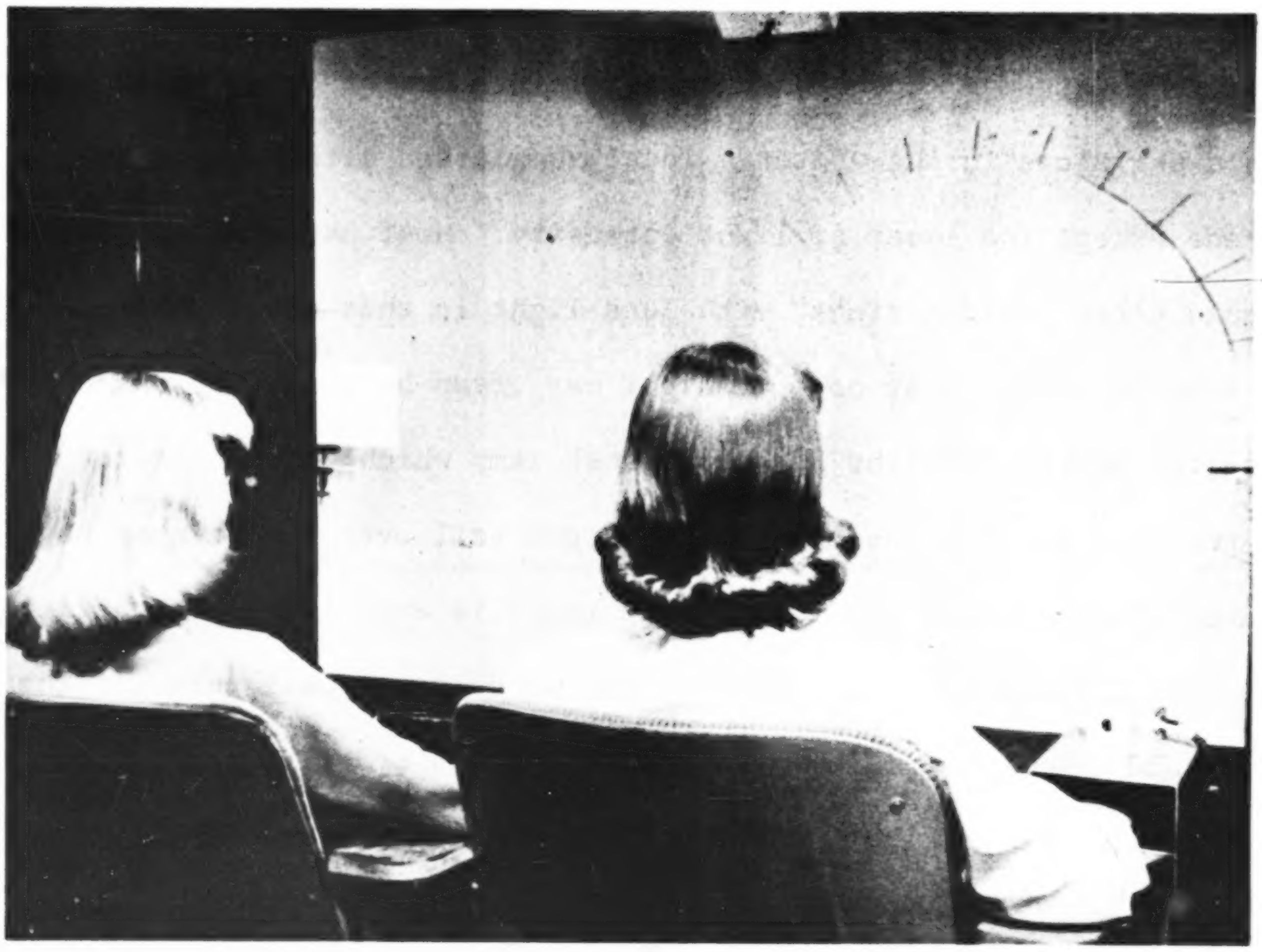

Figure 1. Test subjects in light cube used to study effect of illumination quantity.

is lighted from hidden diffuse sources. Since the reflectances of the screen and cube walls are unchanged, the screen luminance is directly proportional to the level of illumination striking the screen. Light reflection within the cube results in the creation of a luminous environment in which nearly all portions of visible areas of the screen and walls have equal luminance. The illumination reaching the screen is also nearly perfectly diffuse, that is, light rays reach the screen from all possible angles to nearly precisely the same extent. This laboratory cube is very nearly equivalent to the theoretical concept of a perfectly diffuse light enclosure. A slightly closer approximation is achieved in a photometric sphere. For simplification, we will refer to sphere illumination or sphere luminance to describe the special conditions of the luminous environment used in the careful laboratory studies of light intensity.

On different occasions, the quantity of sphere illumination was varied in the experiments to simulate conditions varying from a dark night to a bright day, a physical change in light intensity of more than a million to one. Test subjects performed various tasks involving information extraction at each of a number of different levels of light intensity. Tasks were presented momentarily by trans-illumination through the rear of the screen. Tasks varied in size and configuration and in the type of information required. In all cases, the physical contrast of the task was reduced until the task could just be performed at a criterion level of percentage accuracy. (Contrast is defined as the percentage difference in luminance between the task detail and the average luminance of the screen.)

The effect of the level of luminance of the screen upon the ease of performing the different tasks can be described in a rather simple manner. Define the "contrast sensitivity" of the eye as the inverse of the physical contrast required to achieve a given percentage accuracy for a given task for different values of screen luminance. Then, if the subjects could perform a task with less physical contrast at one luminance level than another, contrast sensitivity would be greater at the first than at the second level.

Different tasks require different levels of physical contrast for equal accuracy of performance at a given luminance level, due to differences in size, configuration, or the informational requirement they represent.

However, suppose we express the effect of the quantity of luminance upon the relative contrast sensitivity of the visual system for performance of each task. This is done by taking the level of contrast sensitivity required for a given task at a standard level of screen luminance as a point of reference, and expressing the levels of contrast sensitivity required for the same task at other luminance levels as percentages of that standard value. As shown elsewhere (Reference 2), this method of expressing visual performance data leads to the discovery that the quantity of sphere luminance has a generalized effect upon the efficacy of the extraction of information of the visual system which describes well the performance of a great variety of visual tasks.

Figure 2 presents the generalized relation derived from a great variety of different experiments, all of which were conducted under

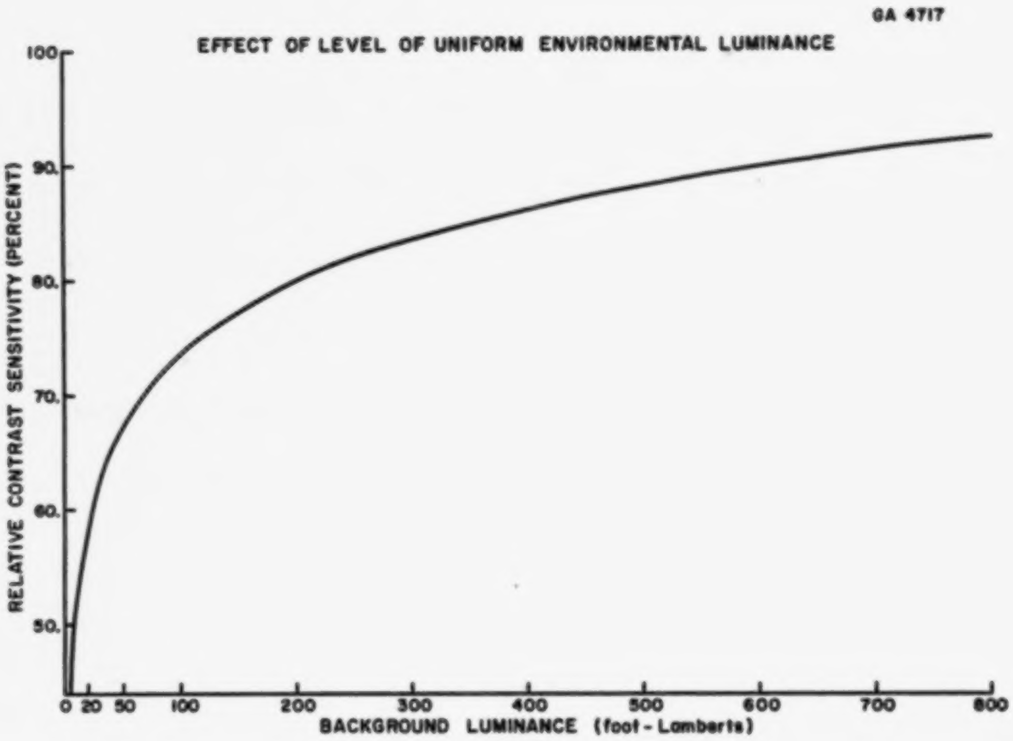

Figure 2. Generalized curve representing the effect of illumination quantity upon visual information acquisition.

conditions similar to those described above, in which the luminous environment was of equal luminance from point to point and the illumination of the visual task was nearly perfectly diffuse. The level of luminance at which contrast sensitivity was standardized was the highest level at which the experiments could be conducted, equal to approximately 3,000 foot-Lamberts. (This luminance is reached by the horizontal sky on a clear day but is exceeded by about 3 times by the highest levels of daytime luminance.) The graph exhibits the generalized relation over the range up to only 800 foot-Lamberts, but this greatly exceeds the values currently used in interior environments. It shows that indeed, more light (higher values of luminance) does produce better sight (greater percent relative contrast sensitivity) under the special conditions of these experiments. Of course, the rate at which sight is improved as light is increased is by no means constant. Rather, vision is improved as luminance is increased at a very fast rate at the lowest luminances, but the rate progressively decreases as higher and higher luminances are involved. (Actually, rates cannot be judged accurated from a linear plot of quantities such as this. A plot of these data on logarithmic scales can be used to deduce the rate relations accurately and the general impressions reached from examination of Figure 2 are found to be correct.)

The data upon which Figure 2 is based can be used to determine how much light an average normal human test subject will require to perform a given task, assuming sphere illumination. We first standardize on the level of performance accuracy we believe lighting should provide for some task for which we have complete data, as a function of luminance, and construct a standard visual performance contour by plotting the absolute values of contrast sensitivity for that task in a graph which will resemble Figure 2 in its general properties. Then, we must establish the absolute contrast sensitivity required for other tasks in terms of the absolute contrast sensitivity required for the standard task at some convenient luminance level. This may be achieved with a device known as the Visual Task Evaluator, shown in Figure 3, in which a visual comparison is made between tasks of interest and the standard task under identical conditions. The values of absolute contrast sensitivity required for performance of the task of interest and the standard task determine the luminance of the task background required to perform the task of interest at the pre-selected level of performance accuracy.

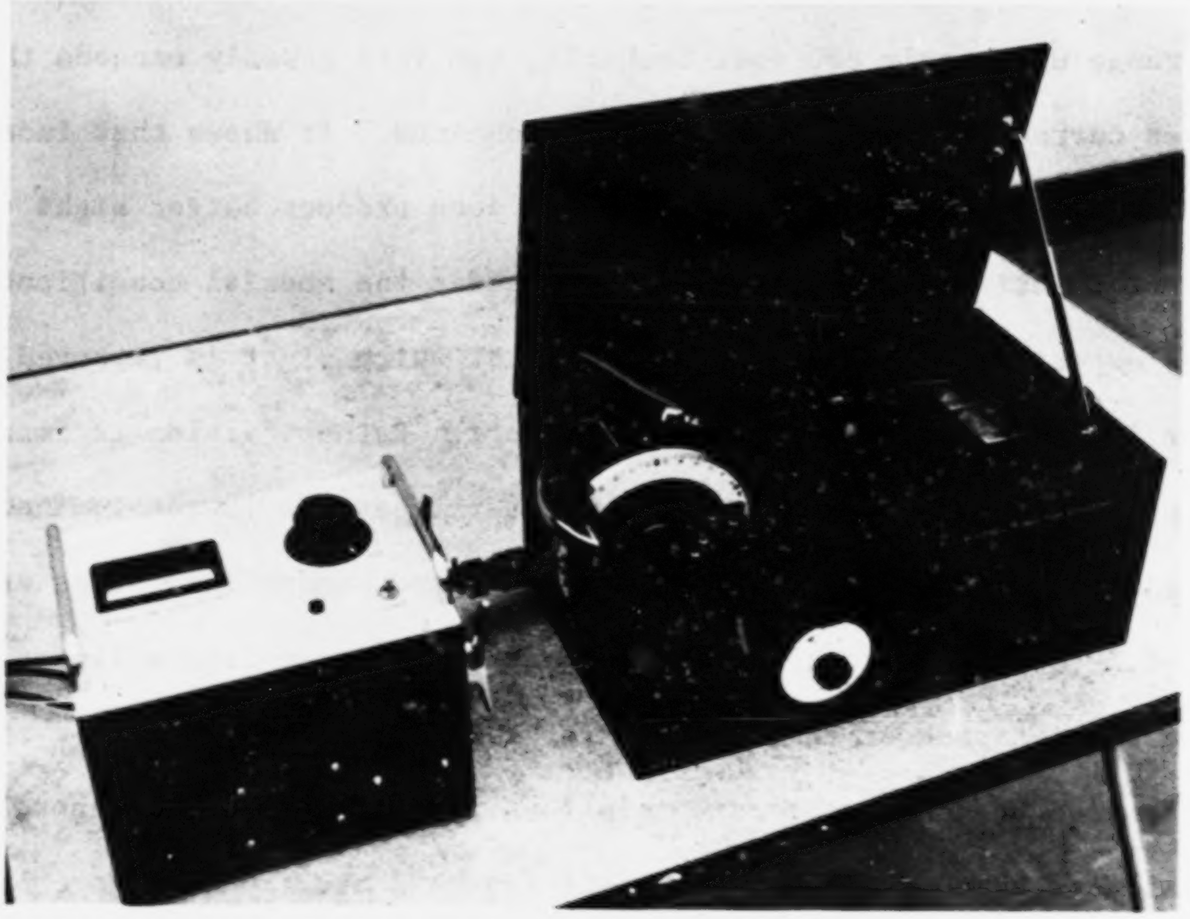

Figure 3. The Visual Task Evaluator (after Blackwell, 1959).

This method was in effect the one adopted in 1959 by the Illuminating Engineering Society based upon the visual data (Reference 1) which were used to define Figure 2. Needless to say, it turns out that difficult tasks require relatively high levels of relative contrast sensitivity and hence relatively high levels of background luminance, whereas easy tasks require low levels of relative contrast sensitivity and luminance. Looked at in this way, we see the purpose of illumination quantity in clear outline. At least under the conditions of the experiments we are considering, as background luminance is increased, the visual system is given an increasingly refined level of contrast sensitivity which permits the acquisition of increasingly subtle and difficult elements of visual information.

The increase in the level of visual information made possible by increased luminance is of the most general nature. Thus, when more contrast sensitivity is supplied to the visual system, not only can the learner read smaller print or handwriting of lower contrast, but he can also detect more subtle changes in facial expression, and for example detect smaller differences in texture or pattern in materials intended to give meaning and pleasantness to the environment. Of course, the acquisition of more and more visual information need not be a boon to the learner. Excessive and irrelevant information acquisition can overload or distract the visual system from the acquisition of relevant information. Thus, clearly high levels of luminance can only make worse an environment whose design provided information irrelevant or distracting to the learning process. However, assuming that the environment is designed to provide relevant information, higher luminances will make increasingly more of this information accessible to the learner.

But what of the examples involving sunglasses and the desk lamp? These examples seemed to prove that more light reduces rather than increases visual information acquisition. Of course, the secret lies in the fact that other factors than light quantity are involved in these cases and we must now consider these other aspects of the luminous environment.

The easiest variable in the luminous environment to measure and understand is what may be called its "contrast rendition" of visual tasks. That is, the physical properties of the luminous environment will influence the physical percentage difference in luminance between the task and its background. In the desk lamp example, the deleterious effect of light is due to the large reduction in the task contrast of the printed material produced by the light veil reflected from the printed page. When this effect is so extreme that we can see an in-focus image of the light source, the effect is designated "reflected glare". When the effect is less pronounced and indeed may not be readily apparent to the casual view, we designate the effect "veiling reflections". In any case, it is possible to measure and describe the contrast rendition factor of the environment as the proportion of the task contrast present under perfectly diffuse light which is "rendered" by the actual environment. Most real luminous environments render no more than 85% of the task contrast present, resulting in values of the contrast rendition fact (CRF) equal of .850. As has been completely documented (Reference 3), the value of CRF depends primarily upon the location of light sources with respect to the line-of-sight to the task. However, it depends also upon the distribution of light emanating from each light source and the extent to which the light rays are plane-polarized vertically with respect to gravity.

Once we can specify the CRF of a luminous environment, assuming that we know how much light it produces, we can evaluate the extent to which the environment permits visual information acquisition. To be precise, we need to know the luminance of the task background in foot-Lamberts rather than the illumination of the task in footcandles. Suppose we have a lighting system of common type producing 100 footcandles. White book paper will have a luminance of about 70 foot-Lamberts. We can assess the value of Relative Contrast Sensitivity (RCS) achieved with 70 foot-Lamberts of perfectly diffuse light as used in our experiments by direct reference to Figure 2. The value of RCS is 70.3. This means that this amount of diffuse sphere light will provide the visual system with 70.3% of the maximum contrast sensitivity of which it has been shown to be capable. But, the physical contrast of the task is reduced to 85% of the value it would have under sphere light. Hence, the effective contrast sensitivity is reduced from 70.3 to 70.3 x .850 = 59.8%. Interestingly enough, we can see from Figure 2 that this level of contrast sensitivity can be achieved by 22.9 foot-Lamberts, produced by about 33 footcandles of diffuse illumination. This means that more than 3 times as great a quantity of light is needed if the lighting system reduces task contrast by only 15%!

These numbers were selected to represent a real case which may have been experienced. Before the advent of fluorescent lamps, systems of indirect lighting had been used to produce illumination levels in the neighborhood of 33 footcandles. Fluorescent lamps allow us to reach illumination levels of 100 footcandles in some instances without increasing wattage. However, the customary use of fluorescent lamps in fixtures of small area and high intensity may lead to contrast rendition loss to .850. Thus, a system of localized sources producing 100 footcandles may in fact be no better from the point of view of our analysis than a system of diffuse light of only 33 footcandles.

(This example is used only to illustrate the over-riding significance of contrast rendition, an aspect of a luminous environment other than light intensity. Fortunately it is possible to design lighting systems today which produce both high levels of illumination and excellent contrast rendition with low wattage consumption. One of the best such systems incorporates large luminous bays of comparatively low intensity produced by installing fluorescent lamps above hung ceilings of light-diffusing material.)

Contrast rendition of different types of lighting systems may be computed by the laborious methods described elsewhere (Reference 3). Alternatively, it is possible to measure contrast rendition in sample installations of various types using the special equipment shown in Figure 4 which has been described in some detail elsewhere (Reference 4). Indeed, there is a current flurry of activity involving the measurement of CRF in various installations by four separate investigators in different parts of this country and Canada. These measurements will go a long way toward revolutionizing the evaluation of lighting systems.

Identification of the contrast rendition variable should clarify the basis for the example of the desk lamp cited above. But what about the sunglass problem? Whatever the contrast rendition factor of an out-

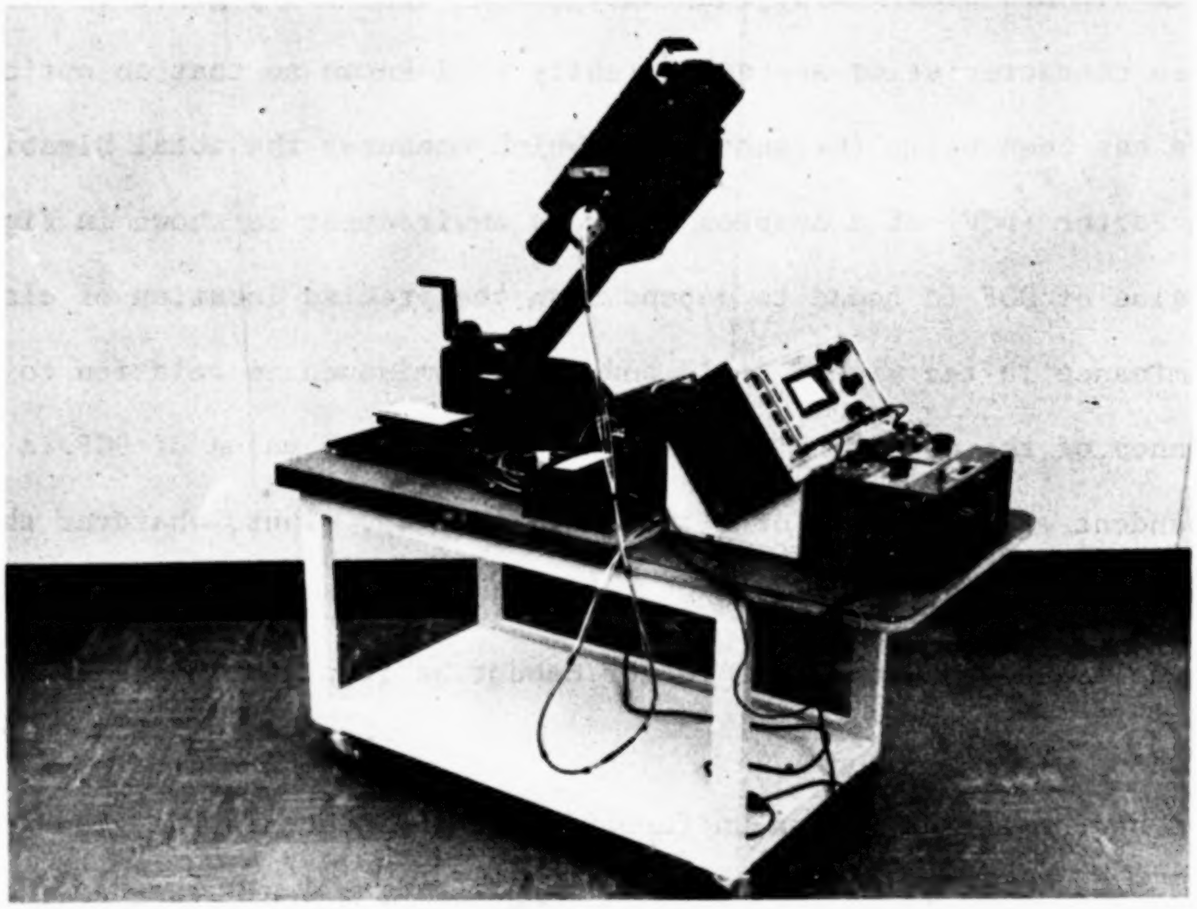

Figure 4. The Visual Task Photometer (after Blackwell, 1967).

door location, use of sunglasses cannot improve contrast rendition since contrast is independent of the absolute quantity of light and sunglasses only control the amount of light intensity reaching the eye. Perhaps it will seem reasonable to suppose that the aspect of the luminous environment related to the sunglass problem is the presence of differences in luminance from point to point in the scene. Actually, luminance non-uniformity in the visual environment has three separate effects which can be isolated by experiment.

First of these effects is the physical effect which occurs within the optical system of the eye, by which the physical contrast of the image of an object is reduced due to "stray light" whenever there is any point in the visual field brighter than the object being viewed.

This effect has classically been designated "disability glare". Its precise characteristics are sufficiently well-known so that an optical device has been built (Reference 5), which measures the total Disability Glare Factor (DGF) of a complex luminous environment is shown in Figure 5. The value of DGF is found to depend upon the precise location of elements of luminance in the visual field and their luminance in relation to the luminance of the object being viewed. However, the value of DGF is independent of the amount of light (Reference 4). Thus, whatever the value of DGF in an outdoor scene, it will be the same with and without the sunglasses and hence, this factor cannot be involved in the sunglass example.

A second effect of non-uniformities of luminance in the visual environment is known as "transitional adaptation", and refers to the

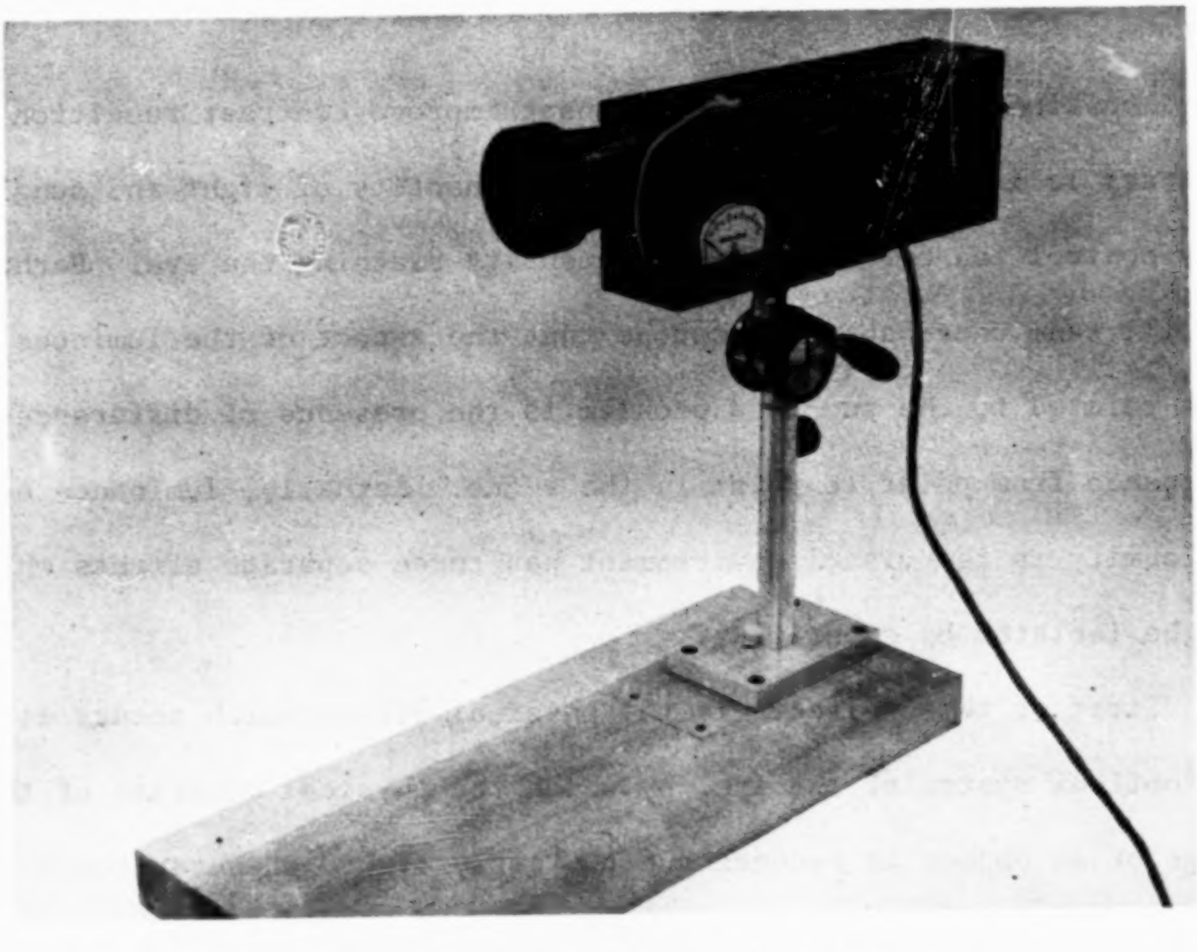

Figure 5. Photometer and Optical Integrating Device.

deleterious effects on the ability of the visual system to acquire information brought about by the changes in the level of adaptation of the system which occur whenever the eye glances from point-to-point in a visual field of non-uniform luminance. It has been shown (Reference 6) that the extent to which the contrast sensitivity of the visual system is reduced by transitional adaptation depends only upon the ratio between the luminance to which the eye is exposed and the luminance of the object containing the desired information. The same loss in contrast sensitivity occurs if the eye glances at a point in the visual field having a luminance one-tenth that of the object or ten times that of the object. Furthermore, the magnitude of the loss in contrast sensitivity is virtually independent of the absolute luminances involved. This last consideration makes it clear again that the transitional adaptation effect cannot explain the sunglass effect, since the loss in contrast sensitivity due to non-uniformities in the luminance of the visual field would be the same with and without the sunglasses.

Before considering the third effect of non-uniformities in the luminance of the visual field, let us pause to appreciate the manner in which the two effects considered thus far can be used to evaluate different luminous environments.

We have noted above that the effect of light quantity under the special conditions of our light cube is to provide a level of relative contrast sensitivity which increases as light quantity increases. But we have shown the luminous environments may fail to produce the physical contrast inherent in a task and that the combined effect of the amount of light and the amount of task contrast may be expressed by multiplying

RCS x CRF. It should be clear that the reduction of the image contrast of an object of interest by the disability glare effect may be treated in an entirely analogous manner. Indeed, we may allow for light intensity, the physical contrast of an object of interest, and the physical contrast of the image of an object of interest by multiplying RCS x CRF x DGF.

Transitional adaptation does not reduce the physical contrast of an object or its image, but it reduces the level of RCS with respect to the value achieved in a luminous environment possessing equal luminance from point-to-point. It has been possible to develop an optical device (Reference 4) as seen in Figure 5 which can be directed around a luminous environment as if it were the eye of a learner, which will record the overall loss in contrast sensitivity due to the composite ratios between the luminances of individual points and the luminance of the object providing information. The device results in a value of the Transitional Adaptation Factor (TAF). The overall effect of a luminous environment can be assessed by combining TAF with the other factors. A single index of merit, the Visual Performance Index (VPI) may be defined as:

VPI = RCS x CRF x DGF x TAF.

This index is obviously intended to express the ease with which visual information can be acquired, account having taken of four variables, which are all the lighting factors known to be relevant to information extraction.

Visual Comfort and Lighting Parameters

Search for the explanation of the sunglass effect leads us away from consideration of the efficacy of information extraction and into consideration of lighting factors which affect visual comfort.

We must begin by distinguishing between two types of visual comfort. First, there is the type of visual comfort which has as its opposite "eye fatigue" or "eye strain". There is no known component in the visual system used to acquire information which can produce discomfort related to lighting parameters. However, the extra-ocular muscles used to point the eyes and to maintain the ocular posture required for binocular fusion can produce discomfort when they are over-worked. Recent unpublished studies (Reference 7) have strongly suggested that the accuracy of eye pointing is directly proportional to the contrast sensitivity of the visual system over a wide range. This is not a surprising result. The oculomotor control system used in eye pointing depends on feed-back control made possible only by the acquisition of information by the visual sensory system. Thus, more fine sensory capacity should reduce the "chatter" in the servo-system used to control eye pointing, thus reducing the work required of these muscles. The next step is to assume, as is commonly done in the eye-care professions, that ocular discomfort of the "eye strain" type is related to the burden placed upon the extra-ocular muscles used in eye pointing. Then, we can conclude that the performance criterion of lighting parameters in terms of the relative contrast sensitivity concept should be directly proportional to eye comfort of the type under consideration. This leaves us again with any explanation for the sunglass effect.

Fortunately for the present exposition, there remains one further type of ocular discomfort, the one related to luminance non-uniformities in the visual field as suggested above. This effect has been designated "direct glare discomfort". It is best characterized by the following experience. Walk into a "well-lighted" room or outdoors. Close your eyes and keep them closed for a few minutes. Then open your lids while looking, say, straight ahead. You may well experience a direct "shock" of ocular discomfort. This experience may be traced to the sudden stimulation of the iris of your eye in response to the sudden change of light entering your eyes when you open your lids. Considerable study of this effect identifies the physical correlates of direct glare discomfort as the luminance of light sources, their size, and their angular distance from the line-of-sight of your eyes. This effect is _not_ independent of the absolute level of light, however. With all ratios of luminance in a visual field maintained constant, direct glare discomfort increases as luminance increases. The explanation for this effect is to be found in the fact that the discomfort is related to the state of initial constriction of the iris muscles as well as the stimulus for constriction, and the state of initial constriction depends upon the absolute quantities of light. The ocular discomfort due to iris stimulation as the eyes glance from point-to-point around a visual environment of non-uniform luminance is reduced, therefore, by proportional reduction of all luminances due to the use of sunglasses.

Analysis of the sunglass problem does provide us with an additional factor to use in evaluating lighting systems. Obviously, we may conclude that we will reduce direct glare discomfort in general by using lighting systems which produce the level of contrast sensitivity we require for visual information acquisition with a minimum of illumination. That is, we should generally prefer a lighting system which produces a given value of VPI with the fewest footcandles. This can be accomplished by maximizing the values of CRF, DGF, and TAF, which can be accomplished with the use of large luminous bays of relatively low luminance. The use of the newly-introduced multilayer polarizers can be helpful since these materials have an especially beneficial effect on the enhancement of the contrast rendering properties of an environment. This effect is not widely understood but has its basis in the fundamental physics of propogation, absorption and re-emission of light by objects containing elements of visual information.

A complete technology does exist for evaluating lighting systems in the visual terms considered here (Reference 8). Unfortunately, the footcandle concept is hard to dislodge even though the simplest considerations reveal how inappropriate and misleading it is to describe the visual effects of light in such terms.

Other Considerations

Our account thus far has been restricted to those aspects of lighting which have direct, known, and quantified effects upon the visual system used to acquire information. Other aspects of lighting undeniably have important indirect effects upon the learner which will influence information acquisition, but unfortunately we cannot quantify these effects to any appreciable extent. Lighting can be used to alert the learner or, as noted above, to distract or confuse him. Lighting can be used to attract attention to the areas containing the most important information, or can be used to convey information directly. Currently, these more psychological effects of lighting upon the learner have to be handled by the informed "intuition" of the architect or the educator. Perhaps the laboratory scientist may someday add to our understanding of these aspects of the learning module, but it is by no means certain that he will or can do so.

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CREATING ENVIRONMENTS FOR LEARNING

by

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Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

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Dr. Ray has had classroom experience at all levels of instruction. He has also been a principal, supervisor, and assistant county superintendent. He has published numerous articles in various educational journals and is Associate Editor of the Journal of Communication.

CREATING ENVIRONMENTS FOR LEARNING

The environment is a critical factor in determining what we can do toward helping children learn.

If we conceive of education or learning as primarily the memorization of information, the traditional "boxes" that have been the basic unit for learning or instruction are probably adequate for many children. If education is to carry children more deeply into stimulating their senses, arousing curiosity, stimulating inquiry and helping them to achieve significant perceptual growth, then the learning environment should be designed with such objectives in mind. The learning environment should contribute considerably to the achievement of the objectives.

In an attempt to improve education, many schools have been designed and built which, rather than focusing upon problems of learning and self-actualization, focus upon solving administration problems. We have so-called campus schools which are intended to house children from primary education through secondary education. We have schools where the classrooms are organized in clusters. We have schools with triangular shaped rooms. We have schools without interior walls separating classes. The variations are many. But the real environment, the environment the child encounters and which does much to shape his curriculum is changed very little from what it has been for many years--not that men have not dreamed, designed and built exciting stimulating environments for learning. The world fairs, such as Expo and the recent New York World Fair, provided numerous examples. The IBM Building with its elevating "people wall" and multi-screen projections, the United States Building which mechanically moved you through a visualization of our country's history, The New York State Building with its 360° panorama motion pictures, and, at Expo, Labrynth, the Czechoslovakia Building, and Kaleidescope were unique. What do these kinds of ideas have to do with child development and learning?

The armed forces have been long noted for innovations in training. The Naval Devices Training Center at Port Washington, New York, has a facility for projecting an image which encompasses a large segment of a visual environment. (Figure 1). The screen is a 22 foot diameter hemisphere, vertically standing. The projection material is taken and projected with a wide angle lens. Imagine, if you will, the inclusion in a school building of at least one room having this feature.

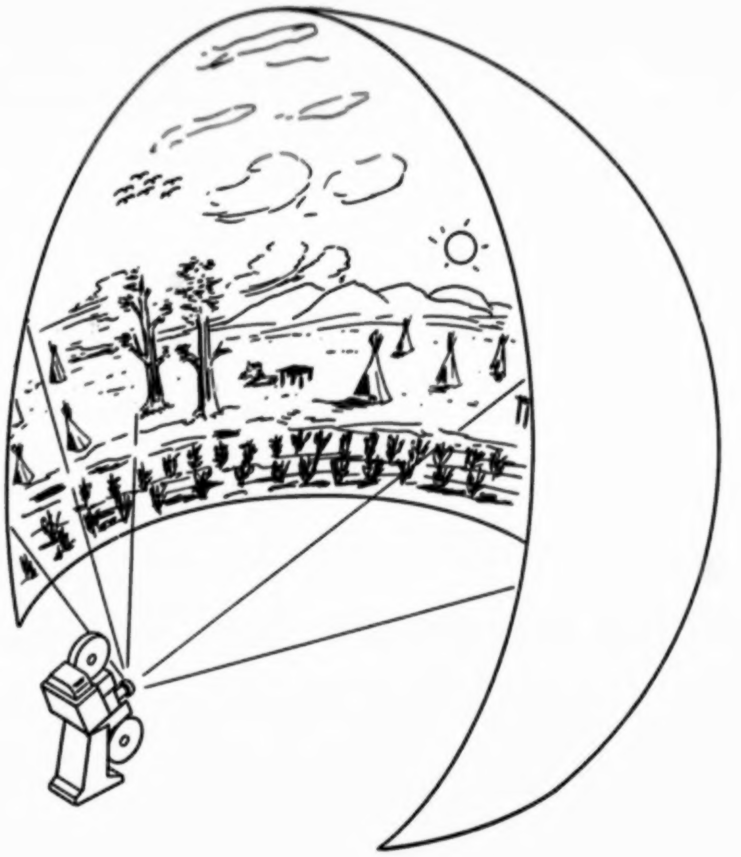

Figure 1. A Vertically Standing Hemispherical Projection System as used by the Naval Devices Training Center

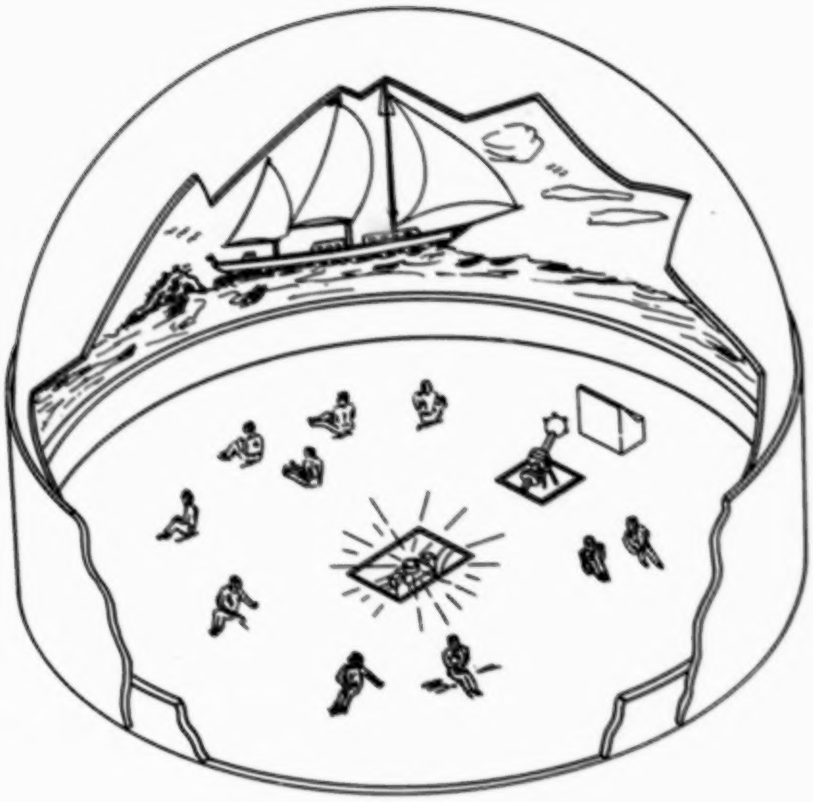

Figure 2. Complete Hemispherical Projection System as used by the Reno Atmospherium-Planetarium.

A variation of this scheme (Figure 2) is used at the Fleischmann Atmospherium-Planetarium in Reno, Nevada, which is operated by the University of Nevada. In this room a projector equipped with a fisheye lens projects a hemispherical image. The original material, of course, would be taken with a fisheye lens.

Another type room (Figure 3) utilizes the imagery reflected off a polished sphere located at floor level in the center of the planetarium. The original image is photographed off a similar sphere--consequently the camera is always a part of the picture. Students in the School of Architecture in the University of North Carolina were experimenting with this idea two years ago.

Another room which made possible the projection of a full circle of environment utilizes several motion picture projectors each of which

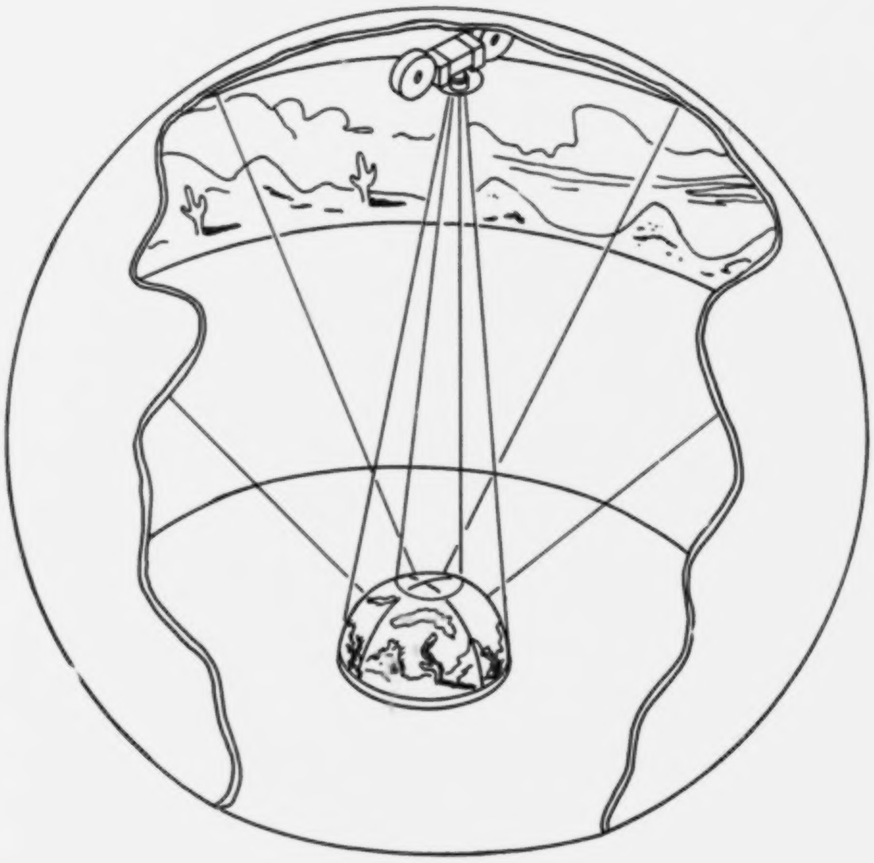

Figure 3. A Special Single Projector Hemispherical System using a Narrow Field Lens and a Polished Sphere.

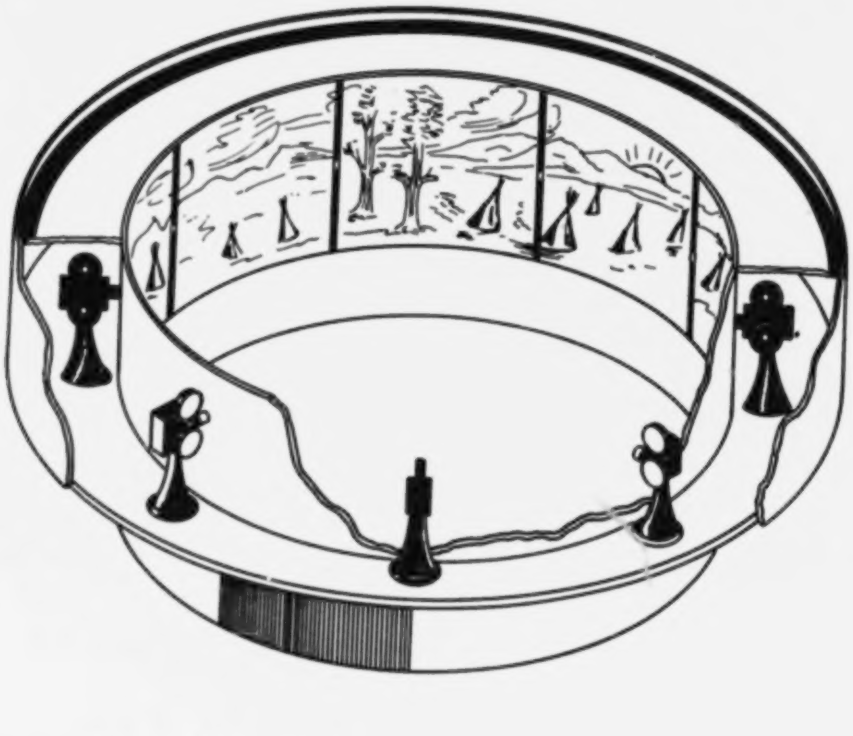

Figure 4. A 360° Cylindrical Projection System at Circarama, Lausanne, Switzerland.

projects part of an environment or situation. (Figure 4). This room in Lausanne, Switzerland, is an example. In the United States an example of this idea can be seen in Disneyland. Eleven projectors convey to the audience a more complete feeling for the content being experienced. The idea was used at Expo and at the New York World Fair. One of the significant aspects of these special rooms and the experiences they provide is that the participant becomes really immersed or involved in the experience. There is a feeling of being in it.

In Warminster, Pennsylvania, a new elementary school was needed to relieve the pressure from the rapidly increasing population. The school district has special classes scattered about the district to meet the needs of the physically handicapped, slow learners, trainable and academically talented children. A decision was made to build a school which would centralize in one building all of these groups with the addition of attendance by the average student residing in the school area. The school environment was planned in great detail by teachers, special consultants, administrators, and the architect. The design (See Figure 5) which emerged and was constructed was based upon three learning centers. One center is a cafeteria/auditorium. Another center is a library. The third center is a special experiences room. Each center has classrooms on the perimeter.

The design of the special experiences room (Figure 6) was the result of asking ourselves the question "What kind of a room would you want in order to do some desirable things with children that our present classroom designs do not permit?"

One desire was much more flexibility for the projection of images.

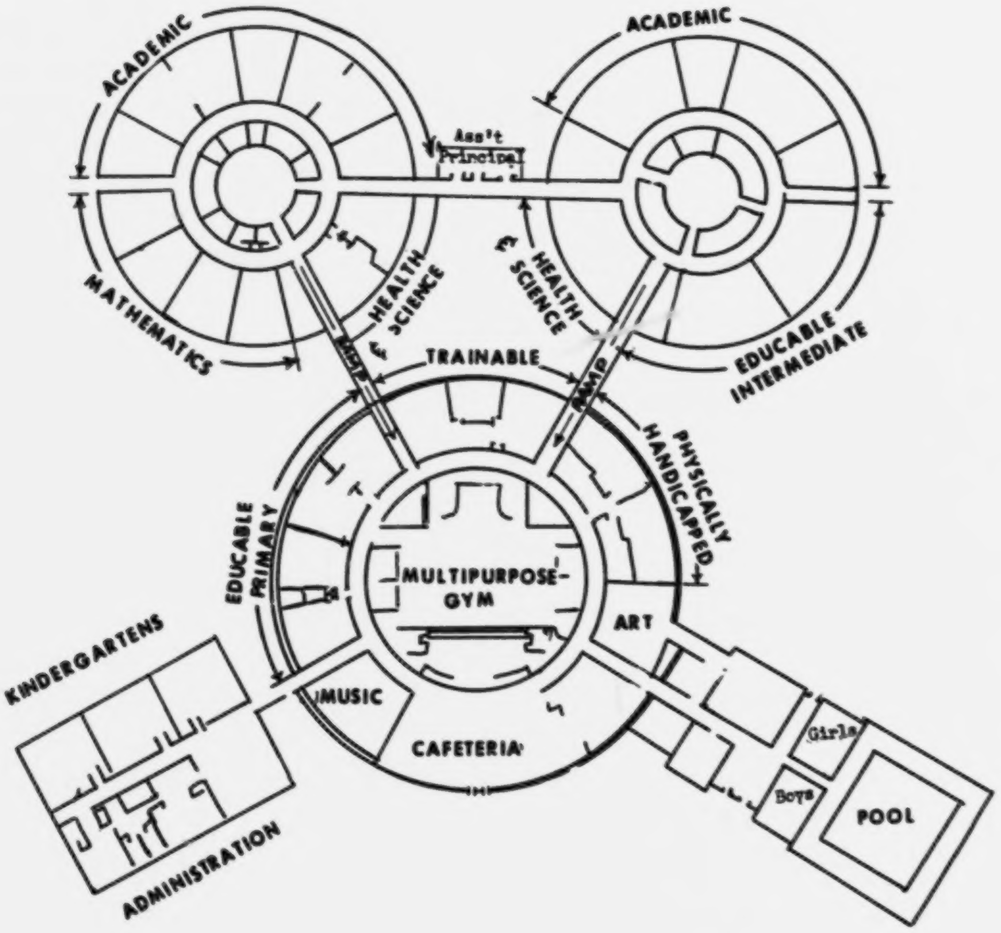
ACADEMIC
ACADEMIC
Ass't Principal
MATHEMATICS
HEALTH SCIENCE
HEALTH SCIENCE
RAMP
RAMP
TRAINABLE
EDUCABLE INTERMEDIATE
PHYSICALLY HANDICAPPED
EDUCABLE PRIMARY
MULTIPURPOSE-GYM
ART
KINDERGARTENS
MUSIC
CAFETERIA
Girls
Boys
POOL
ADMINISTRATION

Figure 5. Warminster, Pennsylvania Elementary School for Special Classes.

For one thing, it was desirable to be able to project images on four walls (Figure 7) simultaneously, thus, giving the child a better sense of environments and relationships existing in all environments. What is it like, for example, to be surrounded by sand dunes, or tropical forest, or great plains? A single, flat picture whether projected or not does not convey this kind of information. Or to be able to project and keep in view contrasting environment--one on each wall space--so that the student could observe for himself the differences that can be perceived in a variety of environments.

We wanted a ceiling projection area too. More of our environment than we realize is above our eye level. Our final design permits unlimited exploration of the overhead dimension.

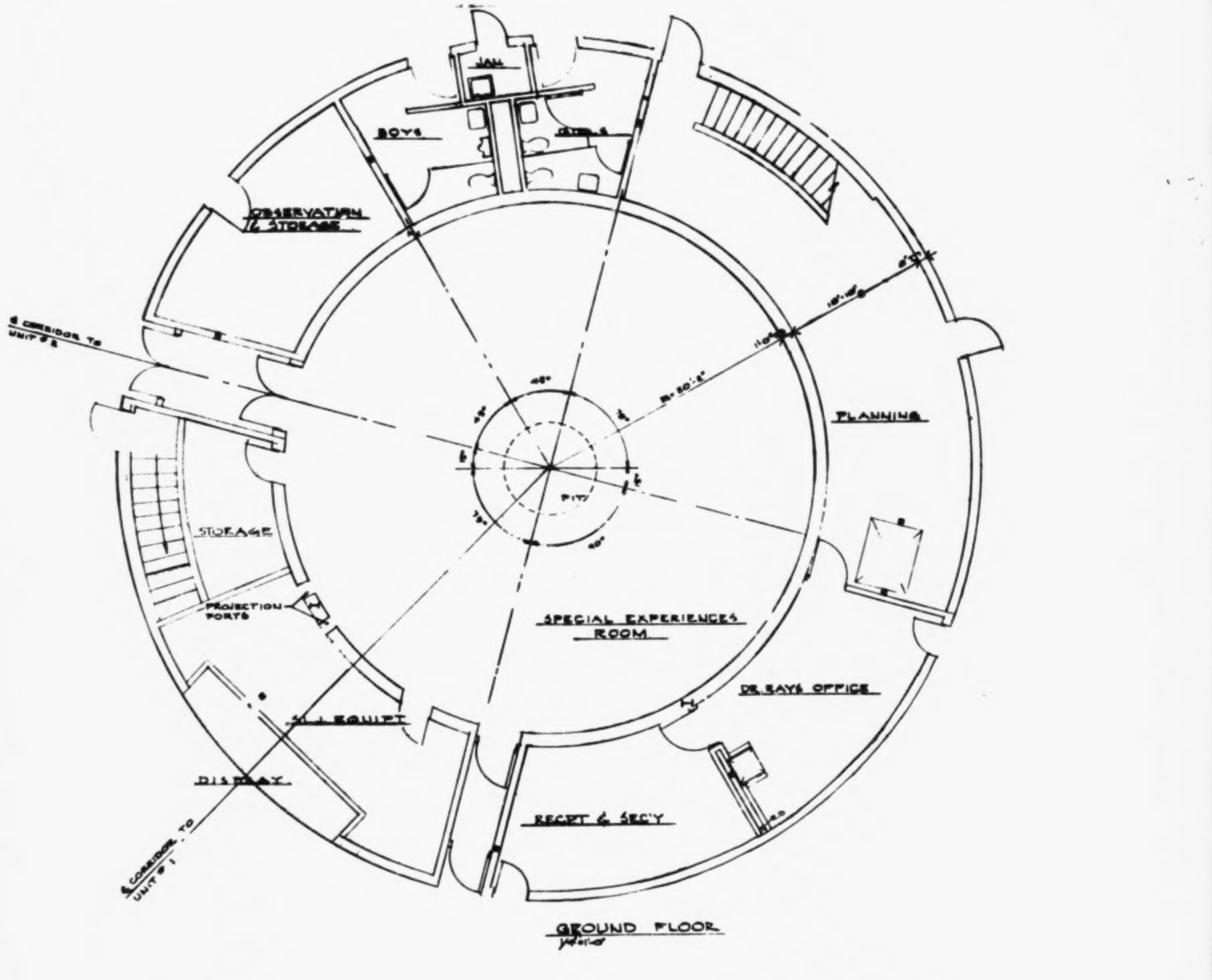
JAN.
BOYS
GIRLS
OBSERVATION & STORAGE
℄ CORRIDOR TO UNIT # 2
PLANNING
STORAGE
PROJECTION PORTS
PIT
SPECIAL EXPERIENCES ROOM
DR. EAYS OFFICE
A.V. EQUIPT.
DISPLAY
RECPT & SEC'Y
℄ CORRIDOR TO UNIT # 1
GROUND FLOOR
BOTTOM OF STEEL
METAL SIDING
DARK RM. & GRAPHIC ARTS
ITINERANT STAFF
10'-10"
CORRIDOR
OBS & STOR.
SPECIAL EXPERIENCES ROOM
DR. EAYS OFFICE
CORRIDOR
STOR.
PROJ. PIT
STOR.
SECTION

Figure 6. Special Experience Room, Warminster, Pennsylvania Elementary School.

We are interested in exploring verticality as a visual learning experience. Anyone who has stood at the base of a giant redwood tree, or the Washington Monument, or a city skyscraper and let his eyes move from the base to the top of the structure understands why this is a concern.

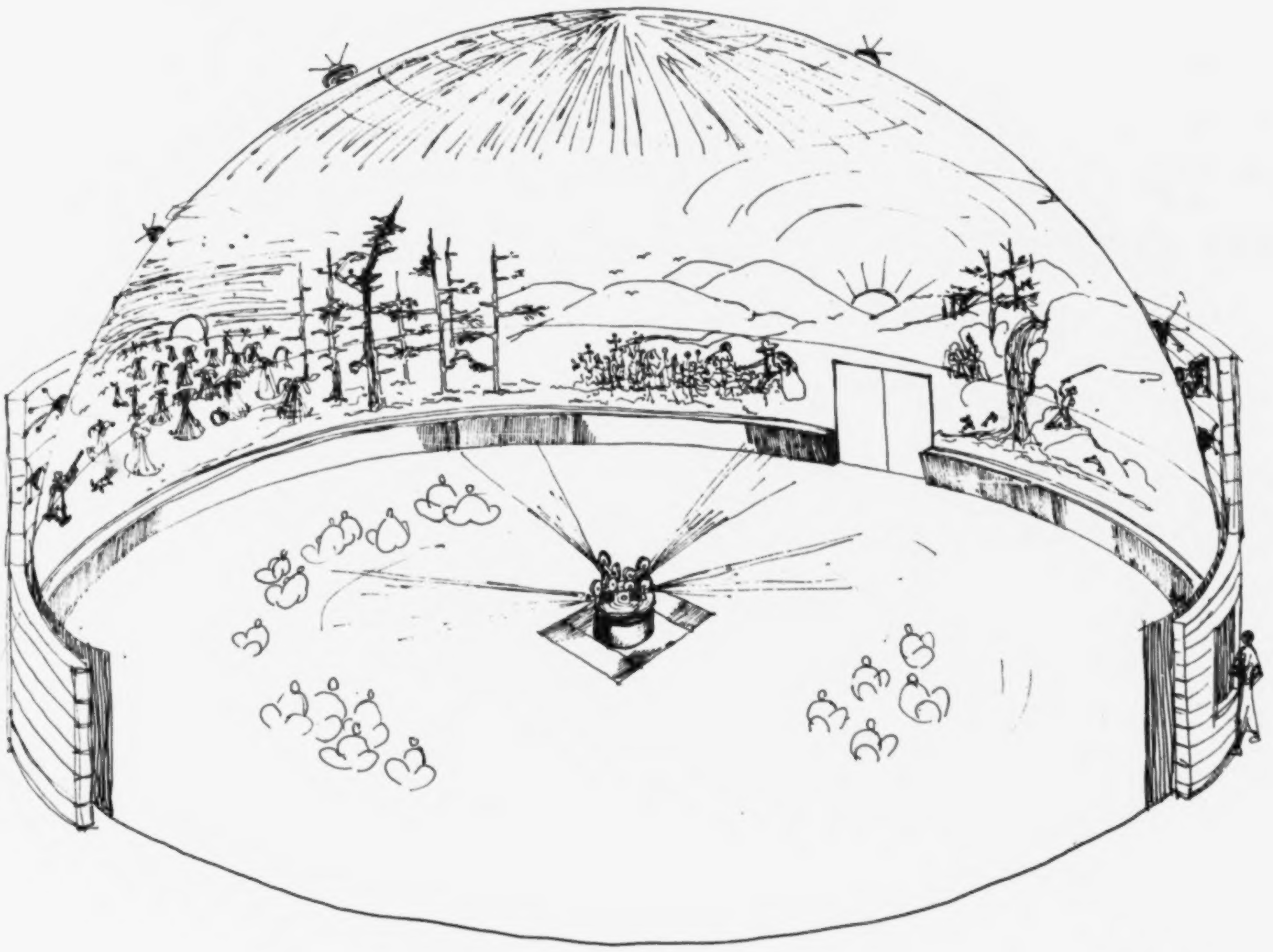

Figure 7. Special Experiences Room - Cyclorama.

We had many other concerns in planning our special experiences center. Our room will permit us to let images move. For example--a film shows a sea gull soaring over the water behind a ferry boat. The gull is sometimes high above the deck of the boat, and at other times it may be near the surface of the water. Given almost unlimited projection surface,our bird will no longer flap its wings within the confines of a relatively small screen. He can move freely about the room.

Our environment will permit projecting the northern or southern hemisphere as a map with the child inside the world looking out. We can project images simultaneously on this map hemisphere which demonstrates some of the common dimensions of humanity. As an example, the small business man--the man with the cart--is a world wide phenomena. In Philadelphia he may be selling pretzels, in England oranges, in Afghanistan slices of sugar beet, in Japan turnips, in San Francisco flowers. Brought together as a unified idea, such experiences might help us achieve a higher level of humanism in education.

Our room will permit us to provide new experiences which might be helpful to children whose learning is impeded because of basic perceptual problems. As an example, how can a child be helped who cannot perceive embedded figures. Utilizing our projection facilities we plan to project slides in series which starting with a simple well-known shape such as a cup retains the cup figure in all slides, but each new slide in the series embeds the figure until in the final slide the cup is a deeply embedded figure. The point to be made is that each slide in the series can be held on the projection area after it is presented so that the child can go back and reinforce his imagery as necessary.

A number of loud speakers are spaced around the room and over the dome. We want sound to travel as well as images.

Odors can be sprayed into the room adding the sense of smell to certain learning experiences--if we can find a source of odors. You may recall the unique presentation of sight and smell the Coco Cola exhibit offered at the New York World Fair.

Limited climate control will be possible. We will experiment with situations where heat, as in a southwestern desert or Florida sub-tropical forest might be a significant factor in the overall perception of an environment.

School systems which have built planetariums with fixed furniture and fixed planetarium instrument and console have short-changed themselves in terms of their ability to provide a broad range of learning experiences. I would like to see projected images low enough that children could touch them--at least the lower section of the projection.

We have not really advanced very far in our thinking concerning learning environments, whether they be for the common masses of students or those who have some physical and mentally handicapped will find conditions more ideal than most students in these groups have experienced. The trainable child, for example, will have an environment where some basic living skills can be experienced (See Figure 8).

We need to search industry and technology and relate our findings to a more meaningful learning experience for all children. What can we do with foam rubber and plastics. Can the light transmission qualities of lucite be utilized to trigger lagging perception in seemingly hopeless learning cases?

What about the furnishings in the new environment? Unique items might be constructed of thin sheet plastic and are inflatable. We have available on the commercial market inflatable boats, inflatable furniture and inflatable works of sculpture.

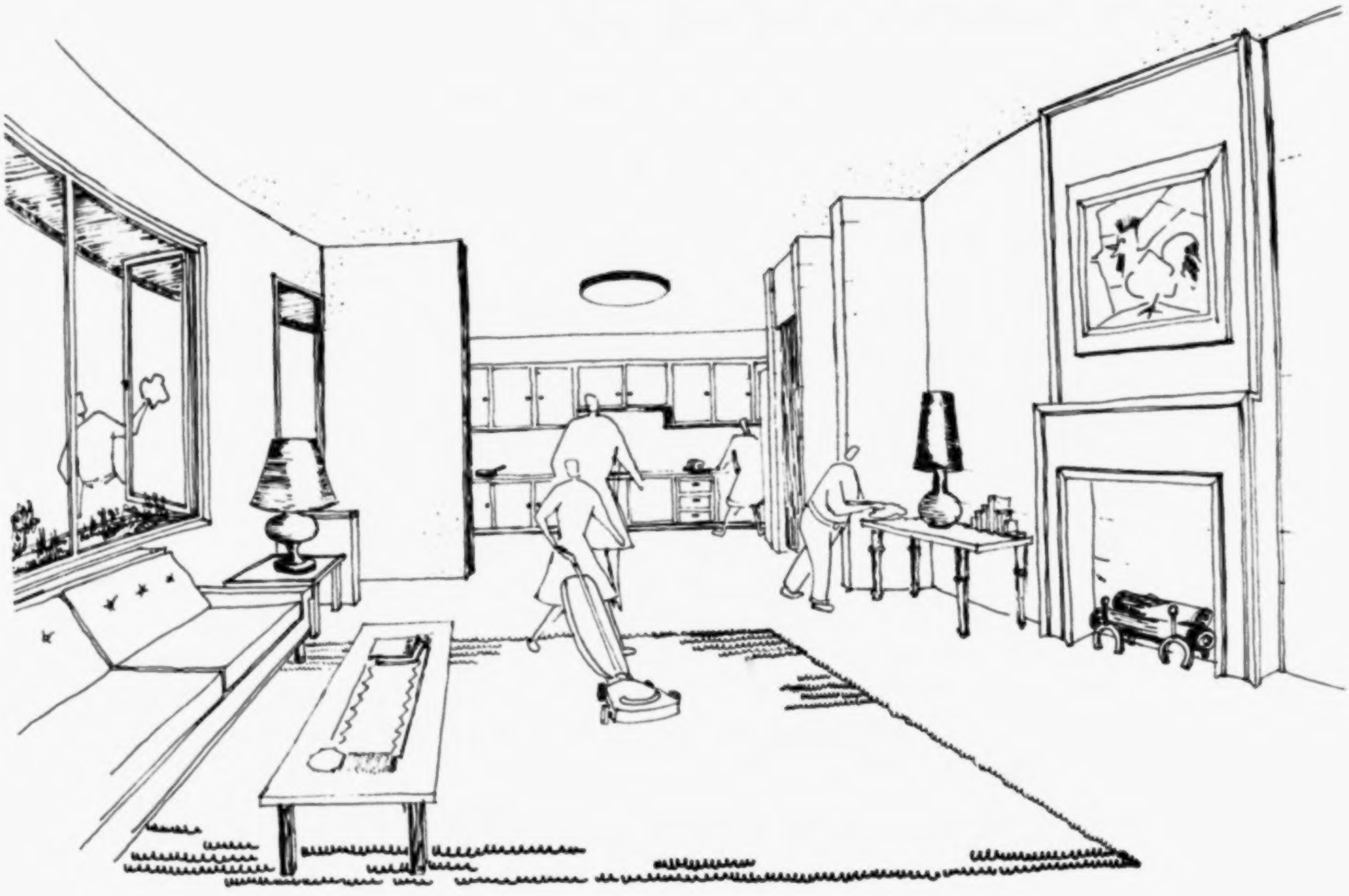

Figure 8. Trainable Classroom.

It would be good to have rooms in which one entire wall is a rear projection screen. It would serve not only as an image transmitter but would lend itself to some unique shadow play experiences which could have great learning potential. Mixed images could be projected providing unusual perception stimulation and learning experiences.

Again speaking of furnishings--a teacher in Abington, Pennsylvania, secured one of the chairs used by Bell Telephone in their exhibit at the New York Fair. These chairs really "embraced" you--and had loud speakers on each side through which the exhibit was explained as one rode through in the chair.

Planning the environment to create the maximum learning opportunity for the child must also include full consideration of what the teaching-learning process activities will be.

A recent publication by the Georgia Department of Education states that the modern social science teacher will need facilities to plan, prepare and present:

assembly programs
bulletin board activities
cartoons
charts
class discussion
club activities
collections
committee work
debates
diagrams
dramatizations
essays
exhibits
field trips
floor talks
forums
graphs
posters
radio
recordings
simple visual aids
socio-dramas
sound motion films
summarizations
television
time lines
guest speakers
illustrated lectures
interviews
lectures
maps
models
music
newspaper reading
clippings
discussions
notebooks
objects, specimens
outlines
pageants
panels
pictures
poems
project charts
readings
reports
slogans
sound filmstrips
stories
surveys
tests

Georgia Department of Education - The Social Sciences Laboratory - 1967.[1]

Most of the items on this list have environmental implications. If each area of learning were analyzed, unique requirements would be identified which should be considered in designing and building classrooms.

Buckminster Fuller[2] had this to say about the learning environment,

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[1] Georgia Department of Education, The Social Science Laboratory, Atlanta, Georgia, 1967.

[2] Fuller, Buckminster, in Conversations on the Arts, Harrisburg, Department of Public Instruction, 1967.

"With knowledge from today's behavioral science studies and the electrical exploration of the brain we have found that, if given the right environment and thoughtful answers to its questions, the child has everything it needs educationally from birth. It is possible to design environments within which the child will be neither frustrated nor hurt, yet free to develop spontaneously and fully without trespassing on others."

Finally, attention is called to an article appearing in the Saturday Review[3], the issue of January 20, 1968. The article, "The Chemistry of Learning" describes the effects of environment upon the problem solving power and brain growth of rats. The rats were placed in psychologically stimulating environments and in psychologically pallid environments. The rats in the innovative environment demonstrated greater problem solving ability and growth in brain weight than the rats in non-stimulating environments.

If so much can be done for the rats--what limits can we justifiably place upon ourselves in our thinking toward implementing the development and self-actualization of the child placed in our care?

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[3] Krech, David, The Chemistry of Learning, The Saturday Review, January 20, 1968, pp. 48-50, 68.

ARCHITECTURE FOR SOCIAL NEEDS

by

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Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

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Among the more prominent facilities in which Mr. Agron has had a major role are the Alaska Psychiatric Institute in Anchorage, Vancouver (Washington) Memorial Hospital, Langley Porter Neuropsychiatric Institute at the San Francisco Medical Center of the University of California, the School of Veterinary Medicine at the Davis Campus of the University of California, and the Feasibility Study on Systems Integration for Veterans Administration Hospitals,

ARCHITECTURE FOR SOCIAL NEEDS

The original subject of this paper was to have been "Programming - Key to Functional Architecture." After two days at this conference, it appeared desirable to broaden the scope of this discussion so that the programming aspect of architecture could be seen as part of a larger whole.

I should like to define architecture for you at the outset, but am unable to do so because of the vast generalizations which the word permits. But however it may be defined, it is my own philosophy that architecture is primarily a social instrument. And, if this is the case, it follows that how society and its institutions think, feel, and act about their problems will enormously affect how architects respond to these problems.

There are a number of logical references which one can derive from these premises if one looks at architecture in its social terms. One is that institutions (present company, of course, excepted) are for administrators. Second, the poor shall not live too well, particularly in new housing. Third, that man can be stretched to the limit of his adaptability, but no further. Finally, that nothing is forever.

With this brief preface, I should like to discuss the Great Pyramid of Cheops, one of the Eight Wonders of the World, built some 3,000 years ago. The architect of this Pyramid served his Pharoah well. He constructed the pyramid with perfect geometry, faced it with sparkling marble, oriented it toward the Sun God's chariot at the appropriate hour of the day, and concealed within it the sarcophagus of Cheops.

There were, however, two significant architectural failures. The architect did not reckon with conquerors who stripped the marble from the tomb, the better to decorate their own. And he did not reckon with the ingenuity of thieves who ransacked the innermost vaults of the Pyramid and stole the golden sarcophagus of the Pharoah. To the architect's credit it must nonetheless be acknowledged that over its time, this structure has proved economic, since it was built at the cost of only some 300,000 slaves. Over the 3,000 years the Pyramid has survived the cost has therefore averaged only 100 slaves per year, which, you will admit, is certainly minimal.

In its own way, this is an example of the fact that nothing is quite forever. But architecture is more concerned with the living than the dead, and it is for this reason that I wish to explore some of the effects of architecture in social terms.

Slums are a universal heritage and their elimination is close to the heart of every government and every architect. The slums in Caracas, Venezuela (Figure 1) are miserable and wretched by any standard, but no different than are found throughout the world. With beneficent intent, the Venezuelan government constructed high rise apartments to replace the shanty town and provide the poor with some of the comforts and conveniences of contemporary life (Figure 2). Two results, however, were unanticipated. For one thing, the suicide rate among the slum dwellers skyrocketed when they were moved into the new flats. Secondly, at every opportunity the inhabitants stole back into the slums.

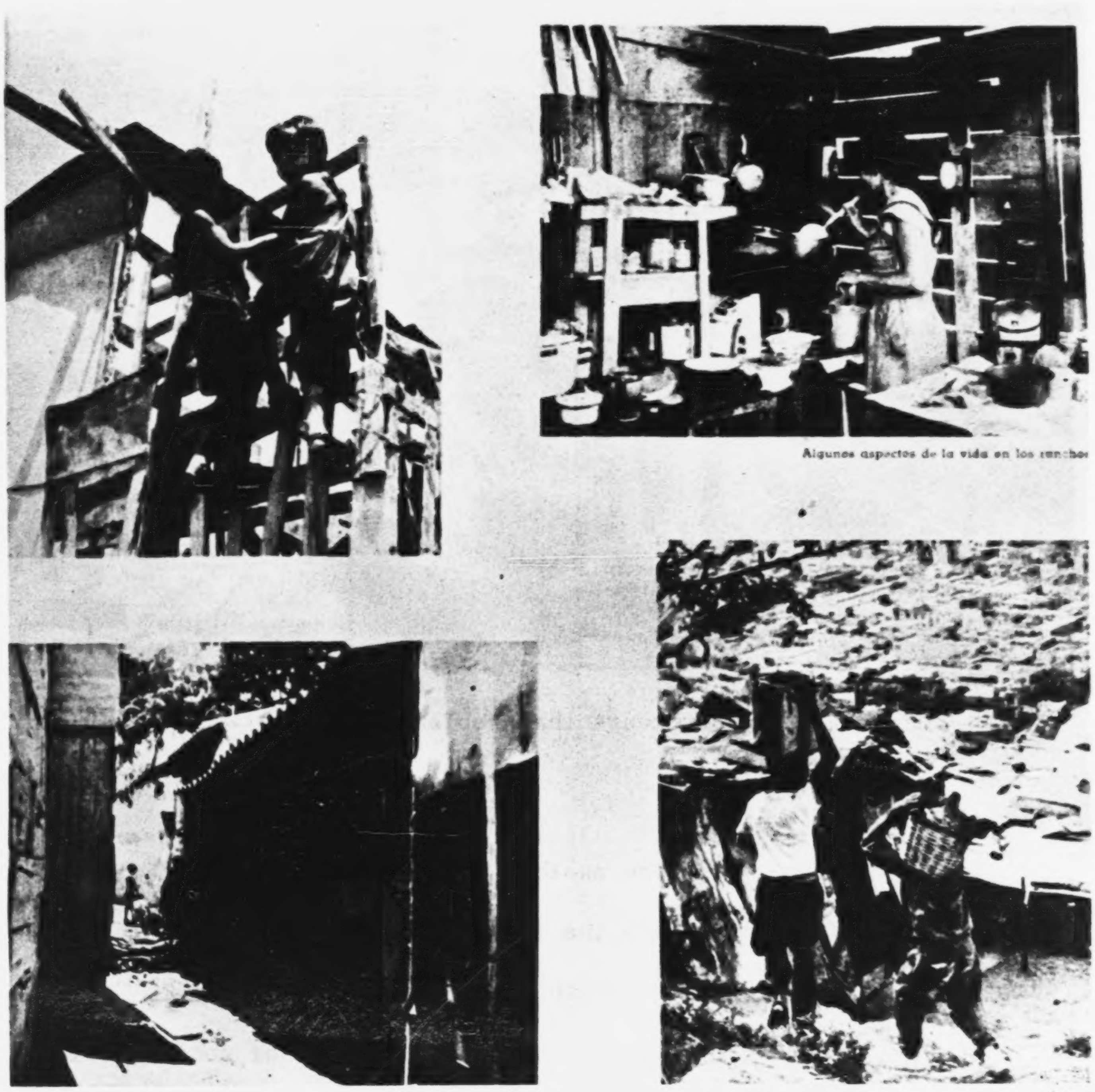


Figure 1. Slum scenes in Caracas, Venzula.

The results could reasonably have been predicted. The superblocks were a translation from another culture with little meaning for the structure of life which had developed in the slums. For the new tenants the superblocks were isolating and alienating. The inhabitants had indeed been stretched beyond the limits of their adaptability, and only

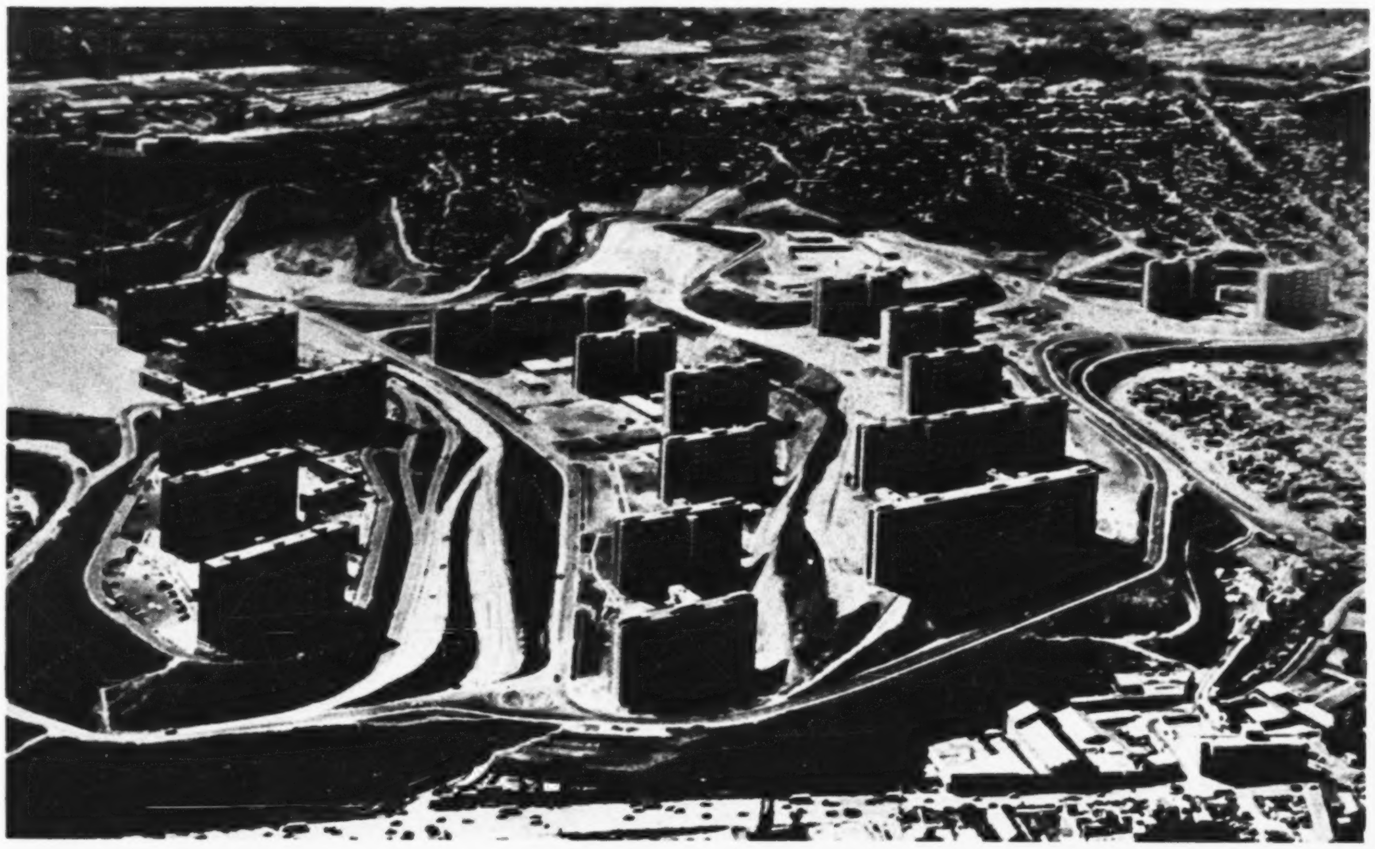


Figure 2. High rise apartments that replaced Slums.

disaster could ensue.

In Mexico City there was another answer to the replacement of a shanty town (Figure 3). Here the identity of the family was respected with individual houses, just as the shanties were individual. The new housing was of familiar scale. With the assistance of social workers who taught the occupants the use and limits of their new housing, the transition was manageable and effective. It is interesting, too, that this housing is very inexpensive, and in a short time, when education and industry have raised the social values of the inhabitants, the project will have outlived its social use and can be torn down, to be replaced by a more appropriate answer to the social need of that day. If it is not, it will inevitably become another slum, no better than

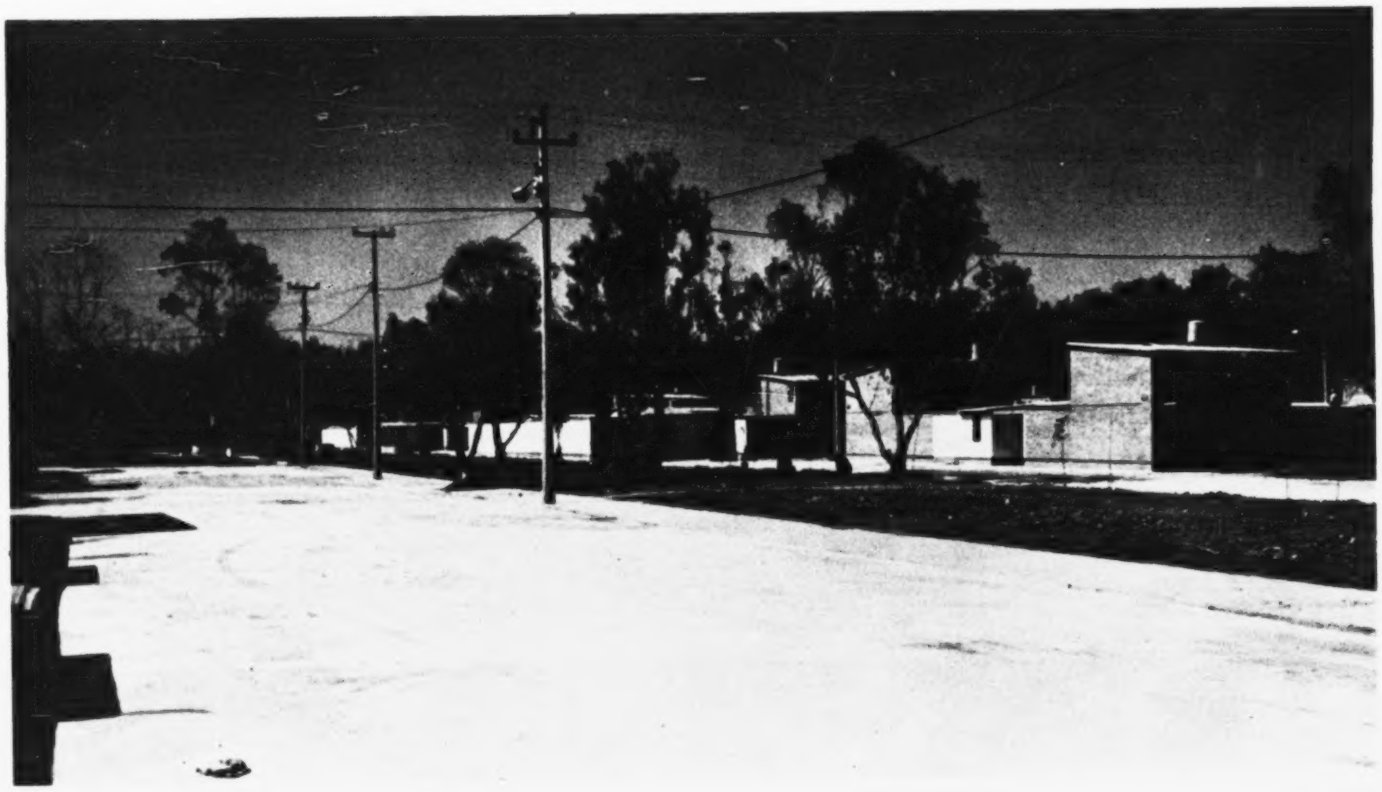


Figure 3. Slum clearance in Mexico.

that which it replaced. But it should be clear that the Venezuelan superblock is the universal answer to slum clearance and the Mexican project almost unique.

Obviously, the Venezuelan government and its architects had no recognition of the social nature and effects of architecture. And until this is recognized and made dominant, the answer can only be destructive. The technology which enables us to construct superblocks is, in itself, of little relevance.

In 1860, Samuel Sloan, an architect working in extremely close collaboration with Dr. William Kirkbride, a most remarkable and distinquished psychiatrist, designed the Pennsylvania Mental Hospital (Figure 4). In my judgment, that hospital was far in advance of the standards of mental hospital design a century later. The collaboration of Kirkbride

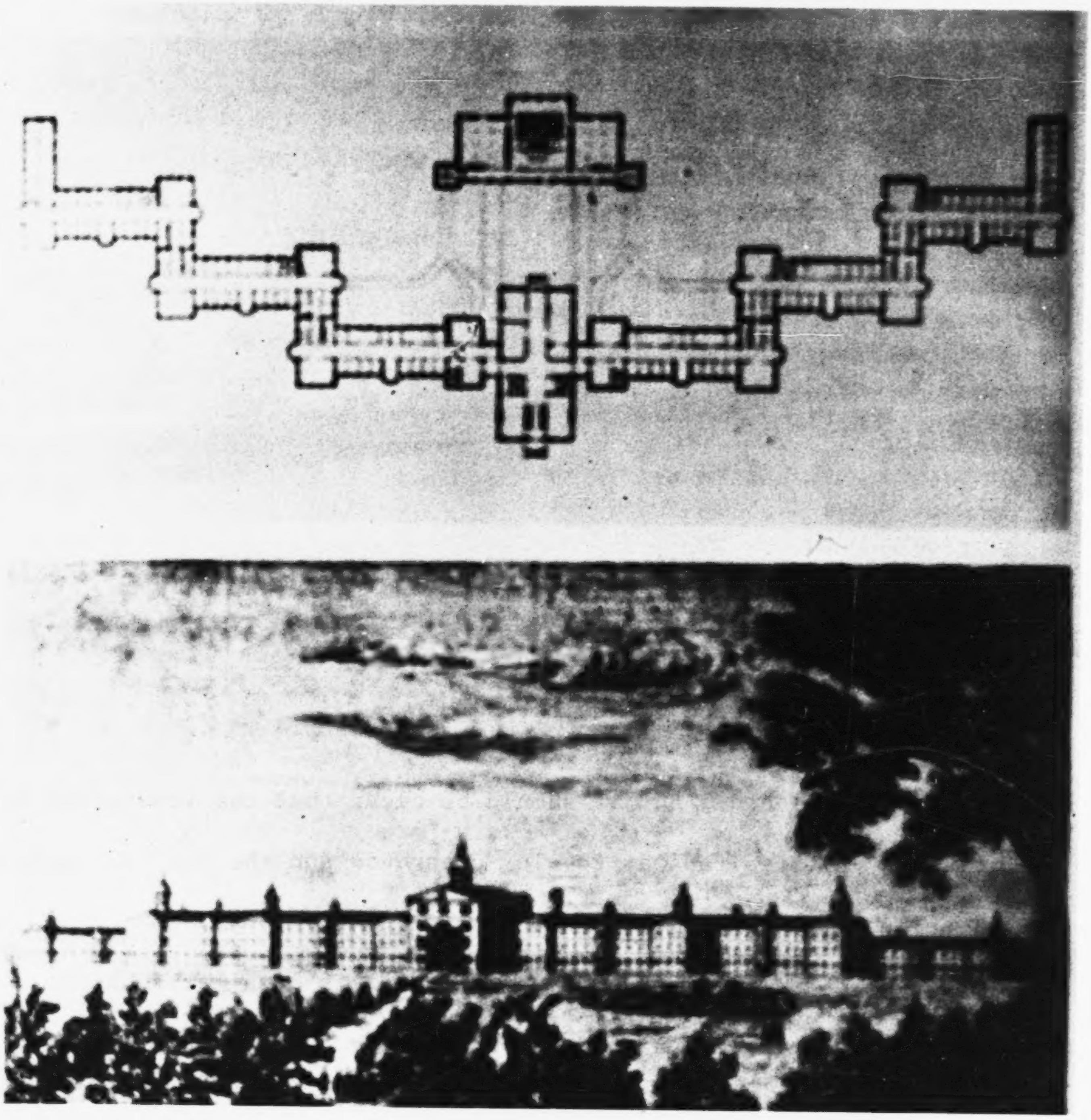


Figure 4. Sloan-Kirkbride Mental Hospital built in 1860.

and Sloan resulted in a broad distribution of excellent mental hospitals throughout the country in the last half of the 19th century, and in many of these institutions sound and effective therapeutic programs were developed.

At the turn of the century, however, a wave of economy struck down this concept of facilities for care of the mentally ill, on the premise that custody was cheaper (and therefore better) than therapy. This had disastrous results for the ill, for those responsible for their care, and for the architecture of our institutions. To this day more of our psychiatric patients are housed in custodial institutions (Figure 5) than in facilities of the quality which Kirkbride and Sloan had constructed in the previous century. Architectural progress is not an inevitability.

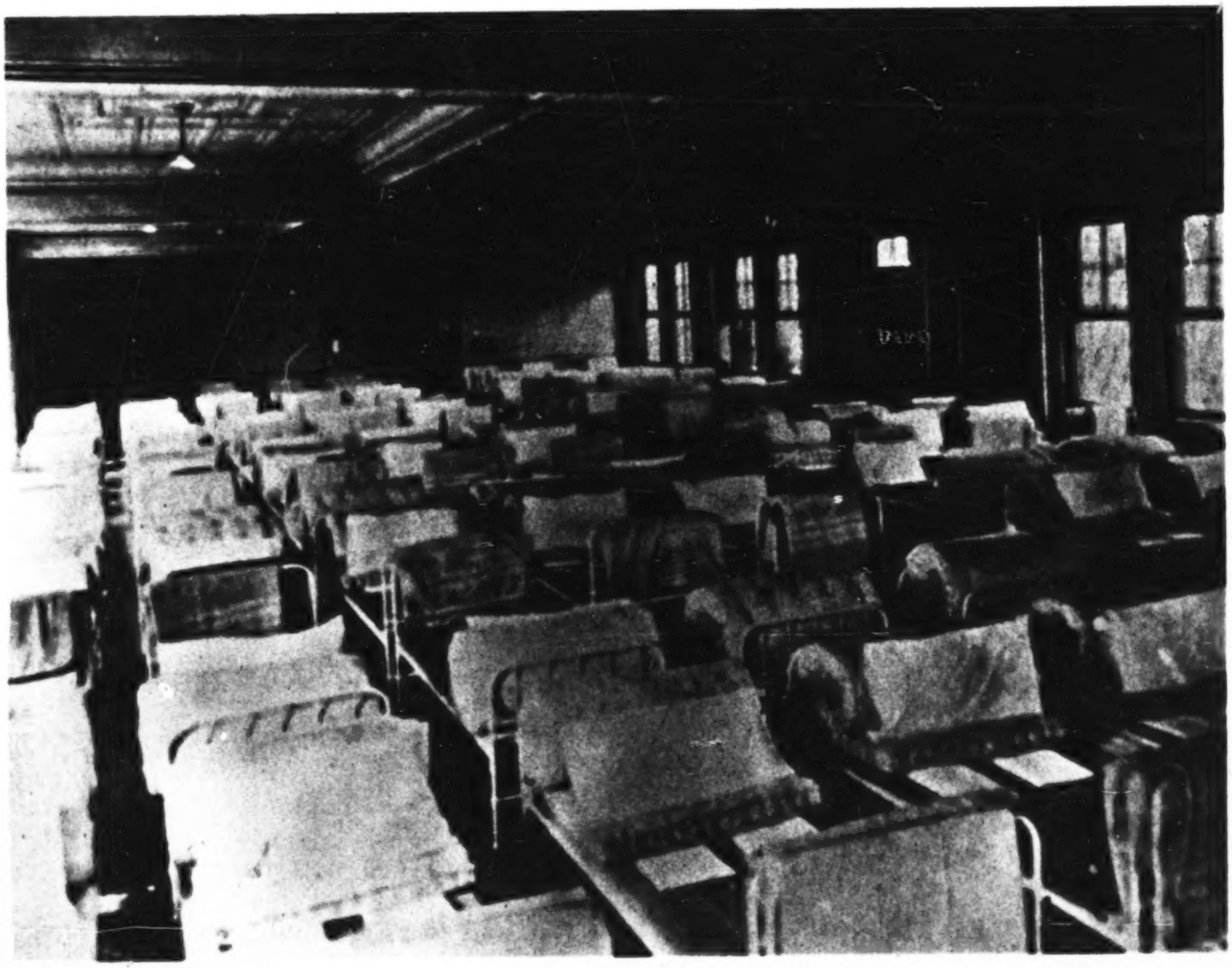


Figure 5. Crowded conditions of custodial era.

At this point, it is possible to describe architecture in a dynamic sense, using a child's toy as an example. Architecture is not a toy and I do not mean to belittle my own profession by using this means of showing one way of describing it. And it must be recognized that this is a limited description, since architecture has many other values.

Consider architecture as a pinwheel with three blades. One blade is the user's needs. The second is the technology of our times, and the third is cost. In themselves, these blades must be balanced. Then, if the pinwheel is to function, there must be wind, and for our purposes, this wind is the social climate. If the social climate is fitful or indifferent, there will be little movement, and the pinwheel will remain static. Conversely, if the social climate is too demanding and if the architectural pinwheel is too weak or unbalanced, the results will be destructive.

It is in these terms that I wish to discuss architecture with you--the architecture of the user's needs (or program, if you will), of technology, and of cost--within the envelope of social climate. And if I am to relate architecture in this way of your needs as I see them, you must forgive my ignorance about deaf children, or educators of deaf children, or educators of educators of deaf children. The information I have to bring to bear on your needs comes from other fields, but I believe its relevance can be established.

In 1917 the University of California built a new teaching hospital for its medical school in San Francisco and wisely asked its architect to master plan the school for long range growth. His drawing (Figure 6, which shows the teaching hospital of 1917 at the far right), projects an enormous increase in size over time, a most valid projection. But that is the only projection. In essence, this type of master planning is highly static, since it does not take into account the possibility

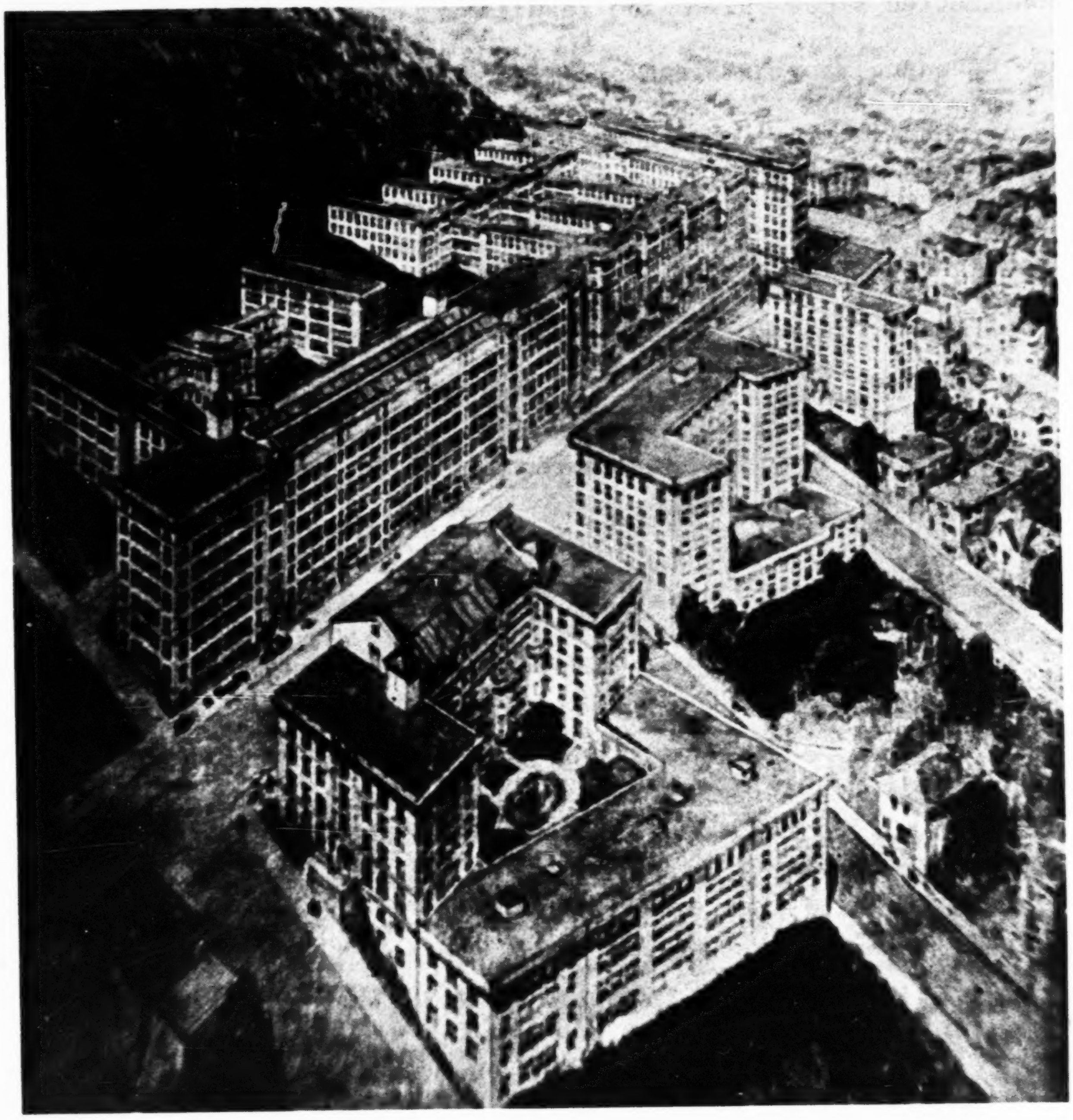


Figure 6. University of California Teaching Hospital built in 1917.

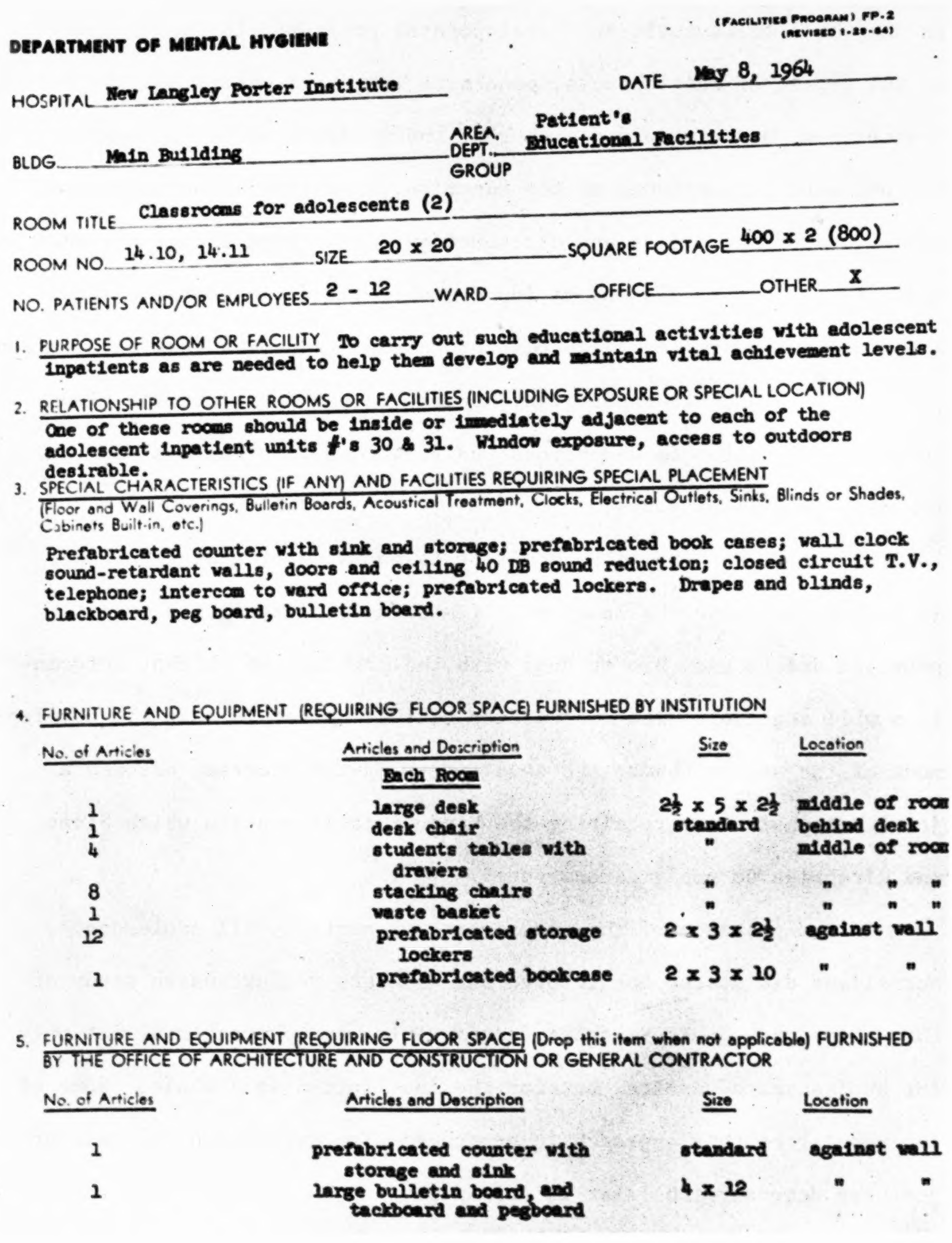
of change in function, technique, or organization. This kind of planning says that we will forever be doing what we do today, only we will be doing it more and doing it larger. Judging from his drawing, there would be no problem with movement of goods or people, since there is a remarkable absence of traffic on the streets of the campus.

I submit that this is not the way medicine, medical education, or traffic did develop, but it is the way in which the buildings have been constructed since 1917. The results are such that the University is now spending many millions of dollars to reorganize its physical facilities to current and projected function, technique, and organization. Lest this University be singled out as the lone health-science facility with such problems, let me assure you that most of America's 114 medical schools find themselves in the same case.

If this example has any meaning, it is that projection for growth and change are not enough. There must be an understanding of the process of growth and change, and there must be an understanding that options and alternatives must always be viable, since no prediction as to the future can have precise and total validity. If this understanding is not inherent in the planning, the results will, all too quickly, become unmanageable.

How do our problems in understanding these processes originate? How can it be that we who have such advanced technological capability have so little recognition of the fact that such a problem even exists?

A clue to the answer is perhaps indicated in the example (in Figure 7) of a page from an architectural program which is typical of the kind of information which architects generally receive from states, cities, counties and institutions. This example is assumed to contain all the information necessary for the proper design of two classrooms for education of mentally ill adolescents. It provides requirements as to the dimensions of the room, its furniture and fenestration. But of what possible use is that information? It says nothing about how or what you teach mentally ill adolescents, or how you might teach them (or not



(FACILITIES PROGRAM) FP-2
(REVISED 1-29-64)

DEPARTMENT OF MENTAL HYGIENE

HOSPITAL New Langley Porter Institute DATE May 8, 1964

BLDG. Main Building AREA, DEPT., GROUP Patient's Educational Facilities

ROOM TITLE Classrooms for adolescents (2)

ROOM NO. 14.10, 14.11 SIZE 20 x 20 SQUARE FOOTAGE 400 x 2 (800)

NO. PATIENTS AND/OR EMPLOYEES 2 - 12 WARD ____ OFFICE ____ OTHER X

1. PURPOSE OF ROOM OR FACILITY To carry out such educational activities with adolescent inpatients as are needed to help them develop and maintain vital achievement levels.

2. RELATIONSHIP TO OTHER ROOMS OR FACILITIES (INCLUDING EXPOSURE OR SPECIAL LOCATION) One of these rooms should be inside or immediately adjacent to each of the adolescent inpatient units #'s 30 & 31. Window exposure, access to outdoors desirable.

3. SPECIAL CHARACTERISTICS (IF ANY) AND FACILITIES REQUIRING SPECIAL PLACEMENT (Floor and Wall Coverings, Bulletin Boards, Acoustical Treatment, Clocks, Electrical Outlets, Sinks, Blinds or Shades, Cabinets Built-in, etc.)

Prefabricated counter with sink and storage; prefabricated book cases; wall clock sound-retardant walls, doors and ceiling 40 DB sound reduction; closed circuit T.V., telephone; intercom to ward office; prefabricated lockers. Drapes and blinds, blackboard, peg board, bulletin board.

4. FURNITURE AND EQUIPMENT (REQUIRING FLOOR SPACE) FURNISHED BY INSTITUTION

No. of Articles	Articles and Description	Size	Location
	Each Room		
1	large desk	2½ x 5 x 2½	middle of room
1	desk chair	standard	behind desk
4	students tables with drawers	"	middle of room
8	stacking chairs	"	" " "
1	waste basket	"	" " "
12	prefabricated storage lockers	2 x 3 x 2½	against wall
1	prefabricated bookcase	2 x 3 x 10	" "

5. FURNITURE AND EQUIPMENT (REQUIRING FLOOR SPACE) (Drop this item when not applicable) FURNISHED BY THE OFFICE OF ARCHITECTURE AND CONSTRUCTION OR GENERAL CONTRACTOR

No. of Articles	Articles and Description	Size	Location
1	prefabricated counter with storage and sink	standard	against wall
1	large bulletin board, and tackboard and pegboard	4 x 12	" "

Figure 7. Typical information received by architect.

teach them) tomorrow. It says nothing of what part the classroom plays in the whole therapeutic and developmental program. It says nothing of the degree of restlessness, concentration, self-motivation, behavioral expectation, and procedures either of the students or of the teachers. Not one word is mentioned on the function, organization or technology involved, nor on options and alternatives. But these things are what the architecture of classrooms for mentally ill adolescents is about. And, if you institutional administrators cannot give us that information, you have no reason to expect that architects can translate the given information about room dimensions and furniture into rational design. The failure will be yours.

On the other hand, the architect is not without responsibility. It is his burden to challenge you if meaningful information is not provided and to know how to deal with the problems which that information will engender. But the essence of this matter is that the development of the user's needs, the development of the program, becomes a joint responsibility requiring the kind of collaboration which Sloan and Kirkbride so amply demonstrated.

In the instance of the classrooms for mentally ill adolescents, our client did accept our involvement with him for extensive study of the philosophy, goals, methods, constraints, and projections, not only for adolescent education, but for the institution as a whole. Some of the results of this approach to program-design development on this project are demonstrated later in this paper.

An important area of program development is the meaningful use of current experience. Today, hospitals in this country are generally organized in one of four different ways (or some combination of them): according to medical service, therapy, medical speciality, and severity of illness, as diagrammed in Figure 8. It is not the architect's

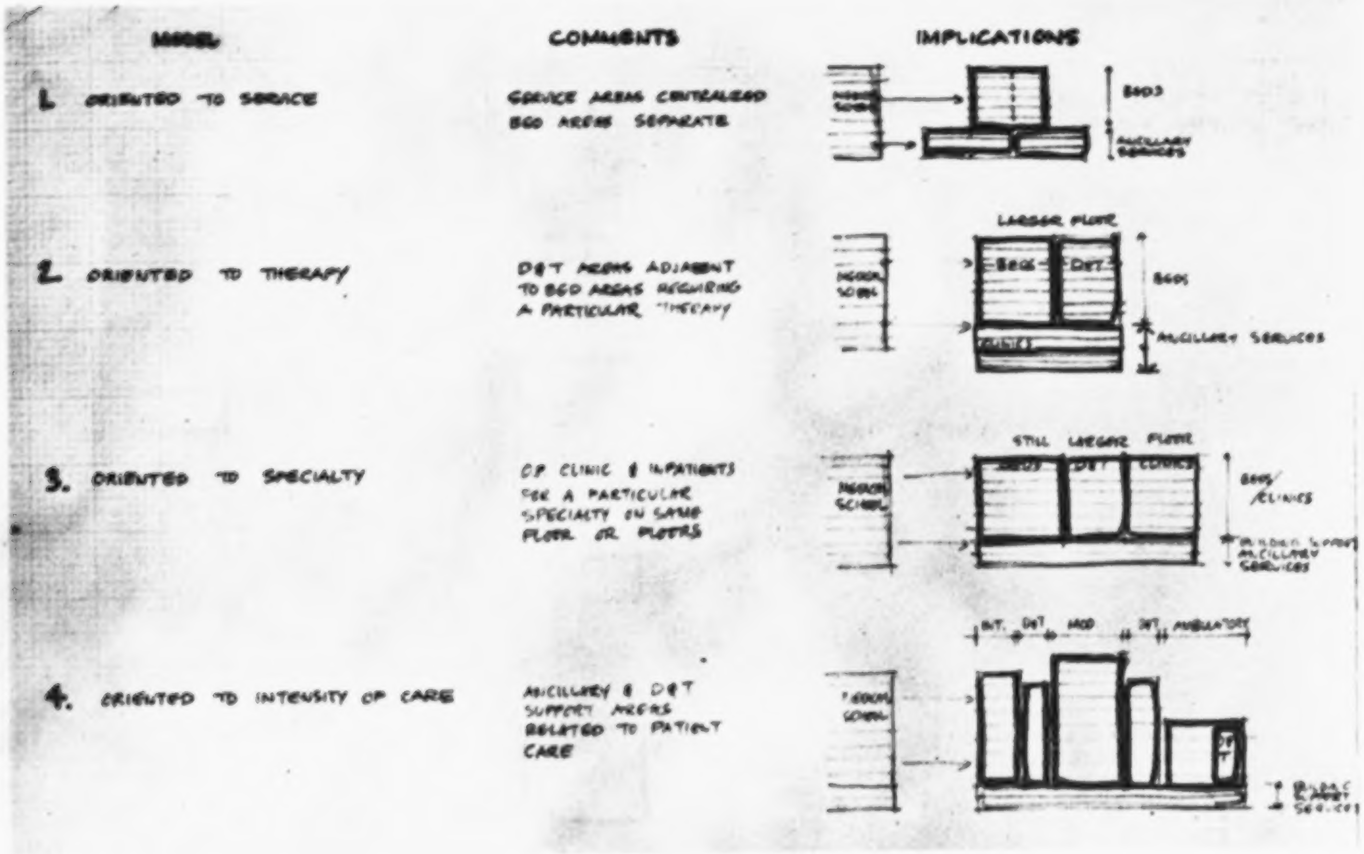

MODEL
COMMENTS
IMPLICATIONS
1. ORIENTED TO SERVICE
SERVICE AREAS CENTRALIZED
BED AREAS SEPARATE
MEDICAL SCHOOL
BEDS
ANCILLARY SERVICES
2. ORIENTED TO THERAPY
D&T AREAS ADJACENT
TO BED AREAS REQUIRING
A PARTICULAR THERAPY
LARGER FLOOR
BEDS
D&T
MEDICAL SCHOOL
BEDS
CLINICS
ANCILLARY SERVICES
3. ORIENTED TO SPECIALTY
OP CLINIC & INPATIENTS
FOR A PARTICULAR
SPECIALTY ON SAME
FLOOR OR FLOORS
STILL LARGER FLOOR
BEDS
D&T
CLINICS
MEDICAL SCHOOL
BEDS/CLINICS
ANCILLARY SERVICES
4. ORIENTED TO INTENSITY OF CARE
ANCILLARY & D&T
SUPPORT AREAS
RELATED TO PATIENT
CARE
INT.
D&T
MOD
D&T
AMBULATORY
MEDICAL SCHOOL
D&T
SERVICES

Figure 8. Teaching hospital organization.

province to determine which of these options is to be exercised in the design of a specific building. But it may very well be his province to design a hospital so that it can change from one organizational pattern to another to meet the needs of rapidly changing concepts of medical care. Pressure for change in hospitals is enormous and continuous, and hospitals can be designed to respond to change if the range of current experience, linked with other options and alternatives, is meaningfully incorporated in the conceptual context of design.

Medical education is, similarly, in flux, and it is likely to continue in that state, since, according to medical educators, there appears no single best way to train our future physicians. Figure 9 illustrates some of the effects of changing educational techniques. If the system

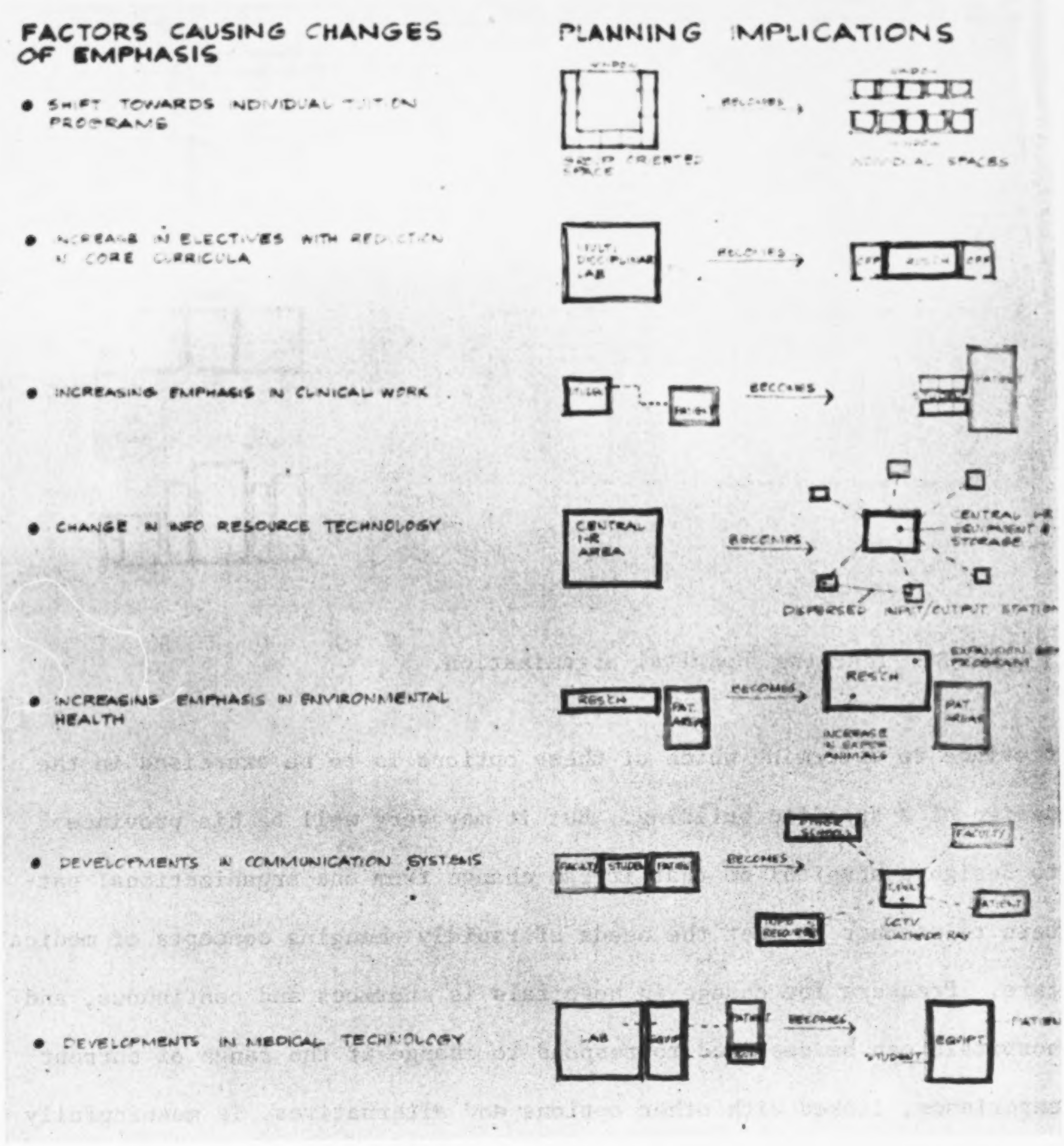

FACTORS CAUSING CHANGES OF EMPHASIS
PLANNING IMPLICATIONS
SHIFT TOWARDS INDIVIDUAL TUITION PROGRAMS
INCREASE IN ELECTIVES WITH REDUCTION IN CORE CURRICULA
INCREASING EMPHASIS IN CLINICAL WORK
CHANGE IN INFO RESOURCE TECHNOLOGY
INCREASING EMPHASIS IN ENVIRONMENTAL HEALTH
DEVELOPMENTS IN COMMUNICATION SYSTEMS
DEVELOPMENTS IN MEDICAL TECHNOLOGY
BECOMES
GROUP ORIENTED SPACE
INDIVIDUAL SPACES
MULTI DISCIPLINARY LAB
RESCH
CENTRAL I-R AREA
CENTRAL I-R EQUIPMENT & STORAGE
DISPERSED INPUT/OUTPUT STATIONS
PAT. AREA
PAT. AREAS
INCREASE IN EXPER. ANIMALS
FACULTY
STUDENT
PATIENT
CCTV CATHODE RAY
LAB
EQUIPT

Figure 9. Teaching method projection.

is changed from group tuition to individualized tuition, the architecture changes. If emphasis on clinical work is increased, the architecture changes. If information resources change, the architecture changes. The list is endless.

The two preceding examples are concerned with the nature of change. But change and growth are inherently associated. Institutions are very complex in structure, and in the relationship of their parts. Those relationships may determine the functional capability of the institution, and these relationships must not be destroyed because of the growth of any element of the institution. Each element grows at its own rate and in its own way, respecting essential relationships and growth rates of other elements. Figure 10 illustrates one approach to the solution of this problem, where growth of elements can occur without disruption to fundamental organizational relationships.

To build static buildings in the face of this kind of capability is incomprehensible, and its consequence can only be waste and inadequancy. It is up to us jointly, you as administrators and us as architects, to understand and apply the tools we have for the development of viable architecture for our social needs.

If we are to make meaningful beginnings, it is necessary to establish a current inventory of institutional experience. This would permit the development of a data base so that evaluation could be made of current practice in terms of programs, construction techniques, cost, rates and nature of change, and similar relevant information. To be most useful, this data must be comprehensible and timely, incorporating foreign experience wherever relevant.

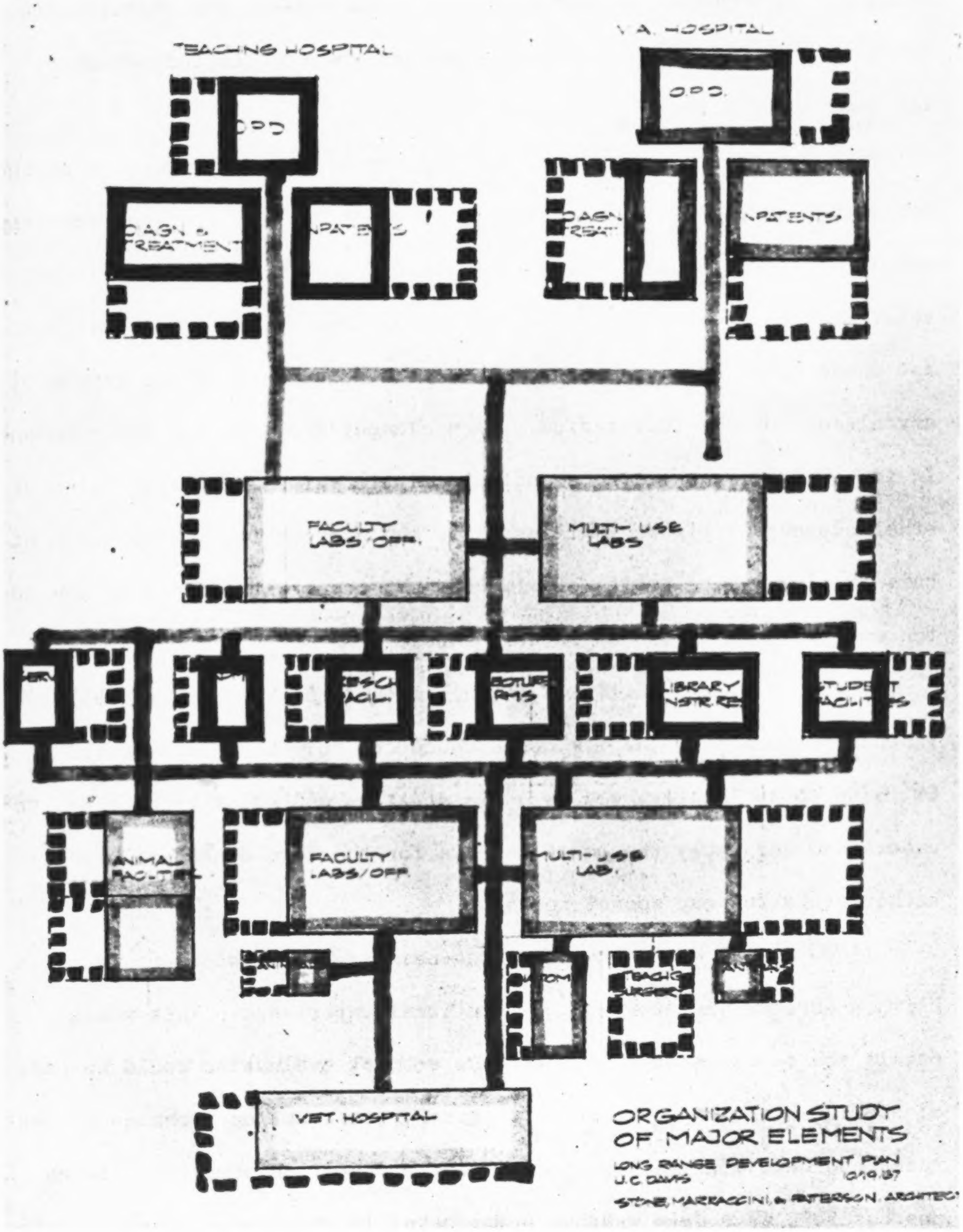
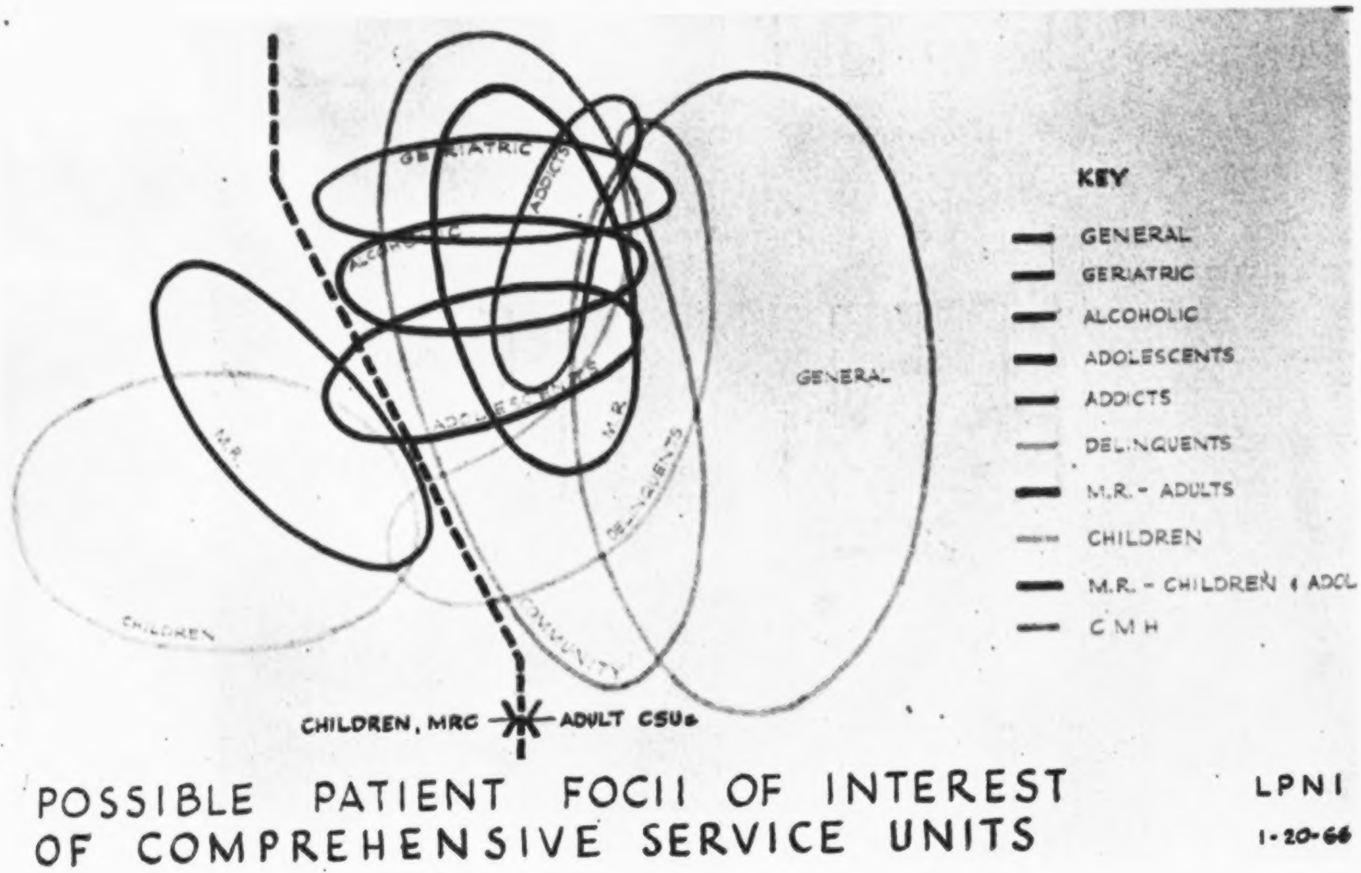

TEACHING HOSPITAL
V.A. HOSPITAL
O.P.D.
O.P.D.
DIAGN. & TREATMENT
INPATIENTS
DIAGN. TREATMENT
INPATIENTS
FACULTY LABS/OFF.
MULTI-USE LABS
RESCH FACIL.
LECTURE RMS
LIBRARY INSTR. RES.
STUDENT FACILITIES
ANIMAL FACILITIES
FACULTY LABS/OFF.
MULTI-USE LAB.
TEACHING SURGERY
VET. HOSPITAL
ORGANIZATION STUDY OF MAJOR ELEMENTS
LONG RANGE DEVELOPMENT PLAN
U.C. DAVIS
10.19.67
STONE, MARRACCINI, & PATTERSON, ARCHITECTS

Figure 10. Hospital plan in which each element can grow at its own rate.

It is also necessary to distrust the information provided, if there is reasonable basis to do so. On one project, we were given the grouping of psychiatric patients in wards according to certain diagnostic characteristics. Extended discussion with the psychiatrists indicated that this was not the way in which patients would be identified or grouped. Figure 11 illustrates the results of this discussion in the form of a Venn diagram. One patient might be identified within the characteristics of any loop of the diagram, but other patients may have characteristics which fall within areas of many loops. The upshot of this discussion was that we could not safely rely on information originally provided. It was agreed that the factor which concerned us was that patients had to be considered as individual people, and that this should be the basis


GERIATRIC
ADDICTS
ALCOHOLIC
ADOLESCENTS
M.R.
M.R.
DELINQUENTS
GENERAL
CHILDREN
COMMUNITY
CHILDREN, MRC
ADULT CSUs
KEY
GENERAL
GERIATRIC
ALCOHOLIC
ADOLESCENTS
ADDICTS
DELINQUENTS
M.R. - ADULTS
CHILDREN
M.R. - CHILDREN & ADOL
CMH

POSSIBLE PATIENT FOCII OF INTEREST
OF COMPREHENSIVE SERVICE UNITS

LPNI
1-20-66

Figure 11. Venn diagram showing grouping of patients.

for design. This discovery that patients are people is perhaps not unique or revolutionary, but it is very infrequently the basis of institutional design.

Figure 12 shows the application of that design principle. The patient is, in architectural terms, a private person, and, as such,

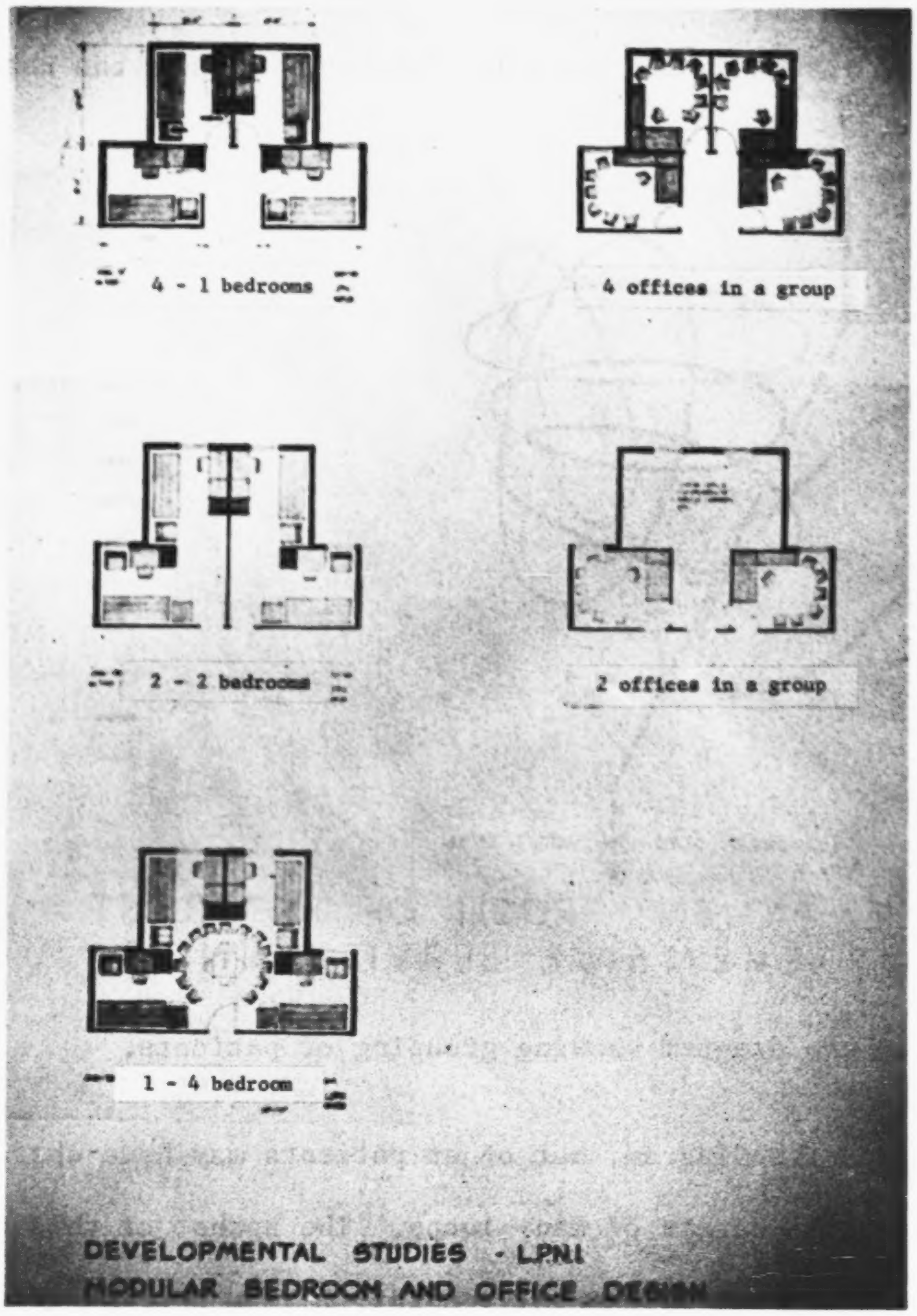

4 - 1 bedrooms
4 offices in a group
2 - 2 bedrooms
2 offices in a group
1 - 4 bedroom
DEVELOPMENTAL STUDIES - LPNI
MODULAR BEDROOM AND OFFICE DESIGN

Figure 12. Modular bedroom and office design.

he commands his own private space - bed, chair, desk, closet, shelves, walls. At the same time, doctors tell us that patients may respond to therapy better if they are grouped in two's or four's. This architecture permits both the retention of the command of private space and the grouping of patients according to medical determination.

This, then, allows the institution a wide range of options for its patients, and it permits change from one grouping to another as may be considered appropriate. Further, it may be desirable to intermingle them, or convert them to teaching, research, or service functions. This is the essence of flexibility, and flexibility is the essence of response to options and alternatives for change.

While flexibility may appear simple in the example given, this is not always the case, nor is it necessarily inexpensive. The doors in the plan shown in Figure 12 are a case in point. For private patient rooms, these doors must open in, but they must be reversible in emergency. For use in psychiatrists' offices, the doors must give protection for the privacy of conversation. The two uses are incompatible, which means that the doors and frames must be changed according to functional need. This is a soluble problem, but not necessarily cheap.

The architecture we are now talking about will not always be housed in simple shapes. The buildings must take on the characteristics which derive from the type of studies previously discussed. In Figure 13, the total organization of a psychiatric ward is indicated, which is based on the concept of options and alternatives. The results provide for flexibility.

To return for the moment to the pinwheel analogy, this design

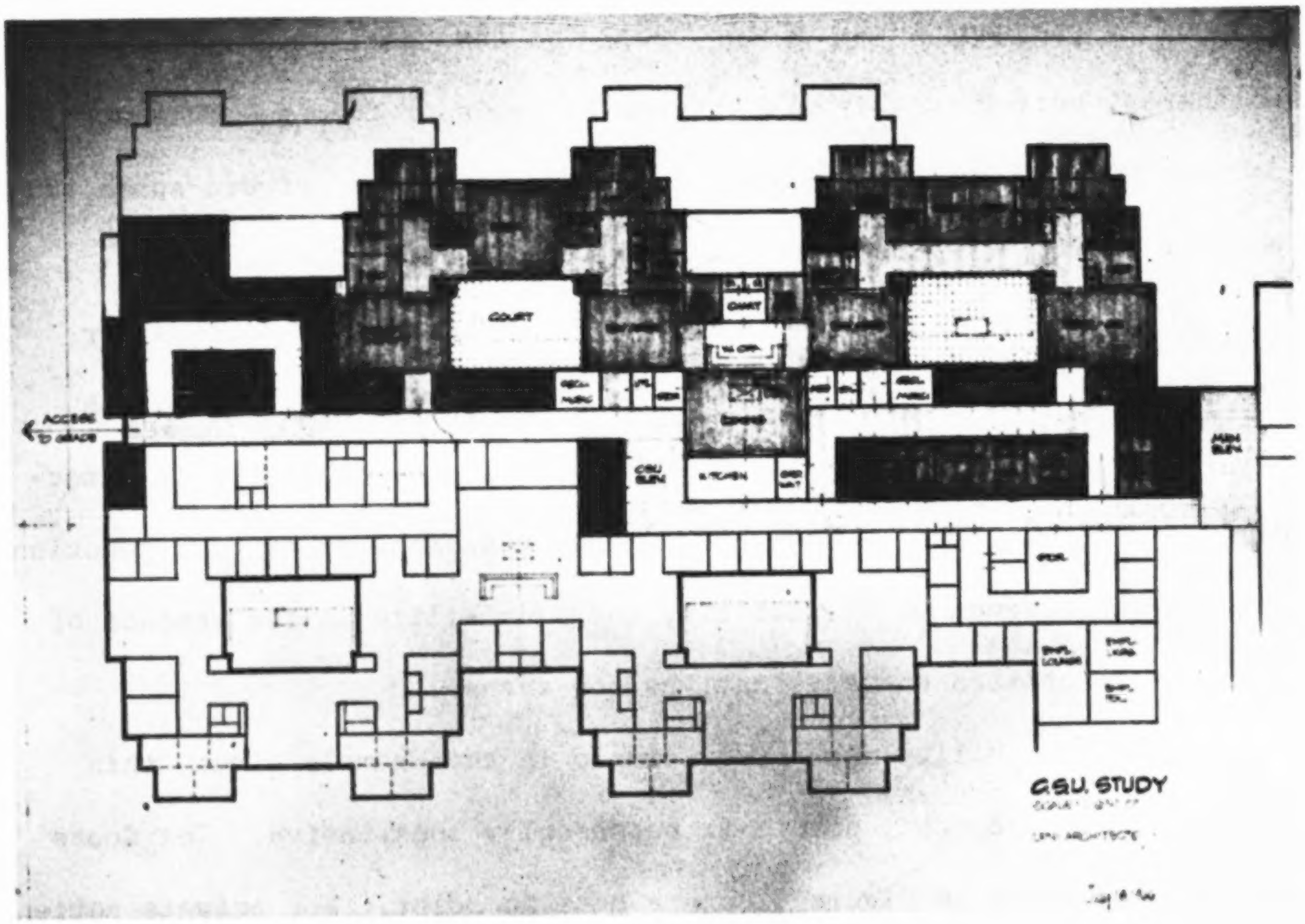


Figure 13. Organization of a psychiatric ward.

responds to the user's requirements, is within the capability of current technology, and can be constructed within the cost structure established. As you may be aware, since 1965 when the design was begun, and the current day, there has been a change in social climate in California which has made this a static problem. That is, funding has been withheld for further design development and construction. There are now indications that the social climate may change sufficiently to permit the pinwheel to begin to move again. But if it does begin to move, it will be a different climate in one important way. Costs have advanced some 9% during the delay, and it can only be hoped that the social climate, cost, need, and technology will remain in balance under the new circumstance.

The bedroom configuration in the preceding discussion is a kind of module appropriate to one particular need or program. The acute hospital has different needs, and, if they are properly accomodated, they will generate different modules with different capabilities. Figure 14 shows a tri-foil scheme for a medical ward of a general hospital. Its organization is such that it can house patients in groups of ten to fourteen, according to their Blue Cross coverage. What is more important is that each of the three elements of the scheme can change without disruption to the organizational pattern of the floor. It becomes possible to convert one, two or all units to laboratory,

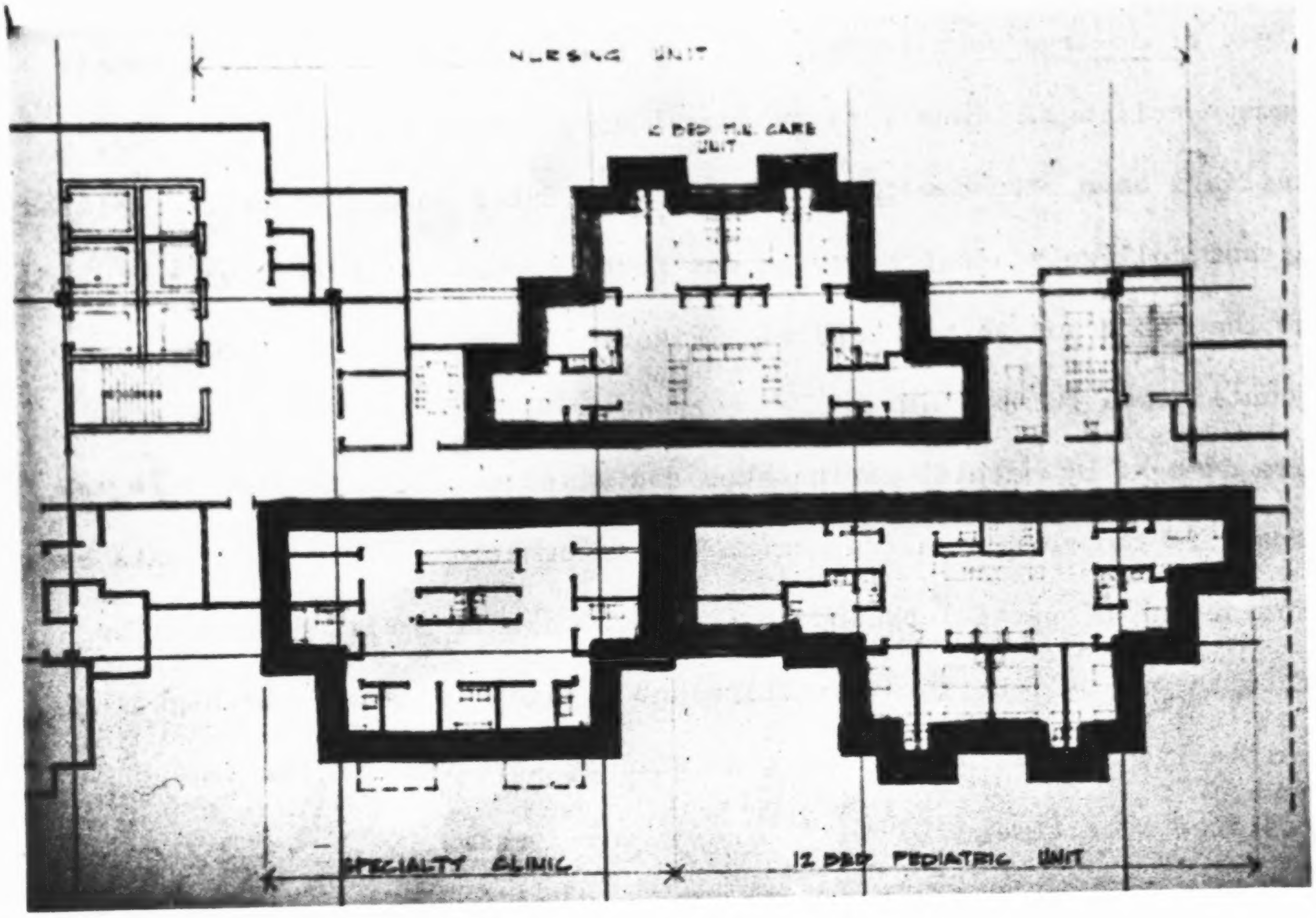


Figure 14. Medical ward of a general hospital.

research, clinic, or intensive care (or other functions) to meet changing needs in medical care, medical education, or research. What this design says in essence is that modules can be developed which have the right size, capability, and organization for response to changing needs.

This approach to design is neither easy nor quick. It is possible and it is necessary. If you do not give your architect the kind of information from which these requirements can be derived, if you do not give him enough time, and I would add, if you do not give him enough money to do the job properly, you will have little right to expect the quality of design essential for viable architecture.

I have touched previously on the inventory of current experience as a guide to architecture. Such an inventory has been made in the field of college dormitories. It has been found that college students damage ceilings. They like to jump. Some 25% of college dormitory ceilings have been damaged in this way. If the damage is to be resisted, either college student behavior has to be changed, which is unlikely, or the force has to be resisted. Figure 15 indicates the force in quantitative terms. Similarly, current experience is that partitions are damaged by people, earthquakes and misadventure with furniture, as shown in the same illustration. This information provides the data base for design of partitions and ceilings which will resist damage. The results may well be that partition and ceiling costs will be higher initially, but the additional cost will be warranted if the damage is resisted over time.

A previous speaker has referred to the poor acoustical performance of rooms where partitions had a rating of 40-50 decibels, but the doors only 10-15. Gang toilets for college dormitories are another example

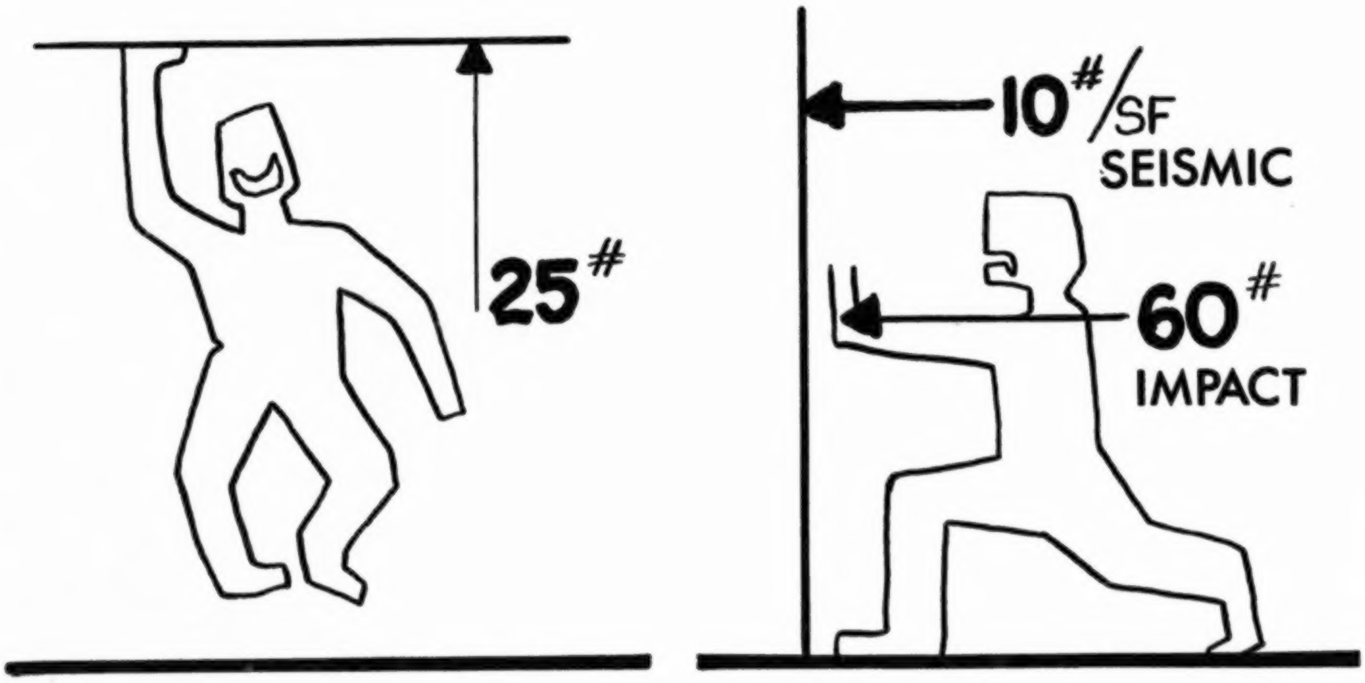
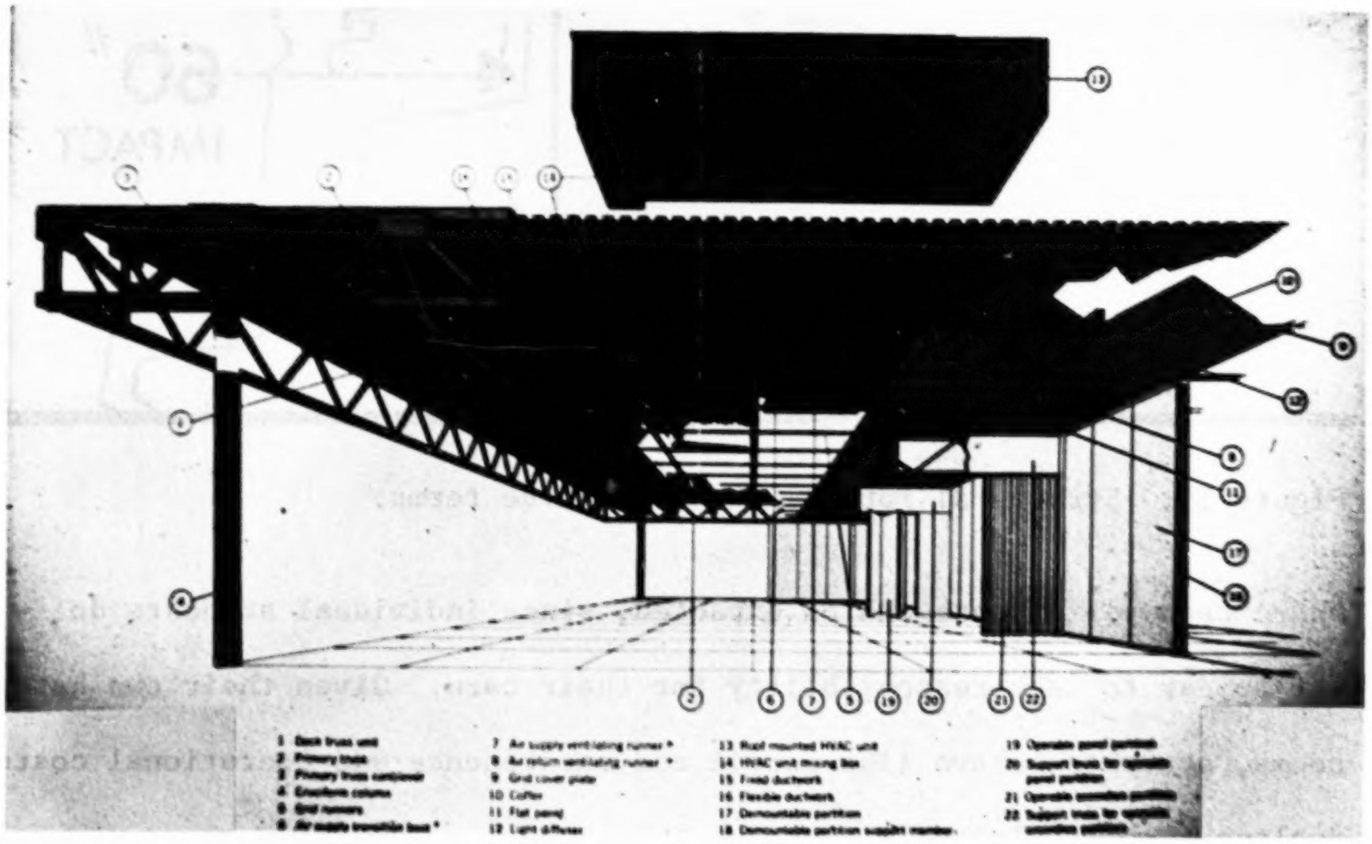


Figure 15. Structural forces in quantitative terms.

where poor performance can be expected, since individual students do not appear to take responsibility for their care. Given their own bathrooms, students behave like people and maintenance and operational costs decline to nominal levels.

Some four or five years ago, a group of California school districts decided to pool their purchasing power to build themselves better schools. They formed a consortium known as the SCSD project to study the capability, cost, and technology of contemporary school construction, with a view to improvement. It was found that to provide flexibility, better performance and higher cost effectiveness, it was necessary to develop new products to meet the need. These products were the structure, ceilings, lighting elements, air conditioning, partitions and cabinets. Industry had to be assured that if it did develop these products so that they fit, one with another, to the desired advantage, there would be a sufficient market to warrant the research and development cost. Given this incentive, industrial firms did work out the technical problems, and the SCSD schools were built, some $20 million worth. The components are illustrated in Figure 16. Using these components, schools of a great variety of arrangement, lighting, and comfort control levels have been designed, built and, modified to meet different educational programs. This project was the forerunner of a program of systems construction which is now on the order of magnitude of $2 billion in the United States and Canada.



1 Deck truss unit
2 Primary truss
3 Primary truss cantilever
4 Cruciform column
5 Grid runners
6 Air supply transition box *
7 Air supply ventilating runner *
8 Air return ventilating runner *
9 Grid cover plate
10 Coffer
11 Flat panel
12 Light diffuser
13 Roof mounted HVAC unit
14 HVAC unit mixing box
15 Fixed ductwork
16 Flexible ductwork
17 Demountable partition
18 Demountable partition support member
19 Operable panel partition
20 Support truss for operable panel partition
21 Operable accordion partition
22 Support truss for operable accordion partition

Figure 16. Components developed by SCSD project.

This may have relevance to your own field of interest, though it is necessary to caution you that your performance requirements, from what I have learned in the course of this conference, are more exacting than those of normal schools, and you may not find existing answers to your needs within current programs. Nonetheless, it would be well worth your inquiry to determine whether the systems in use will serve your purpose or will require modification within your economic capability, or whether your problems are so specialized and your part of the building market is so small that you may not, at this time, benefit from this approach to your needs.

Let me discuss with you some of the benefits of poverty, properly applied. The design of a prototypical British hospital, which they designate as "Best Buy," is as large as our average County hospital, with more than 700 beds (Figure 17). It is designed on two floors, and it is to function with only two elevators. It is intended to respond to the needs of the British health system and to do so with initial and long term economies. I am using this illustration only to indicate that our impoverished British cousins have employed the pinwheel analogy, balancing their needs, technology, and costs within their economic and social climate in a functional manner. Poverty, it can be established, is no excuse for architectural illiteracy. One does with what one has, and if the resources are properly organized, the results can be remarkable. Perhaps we can learn from these experiences to our own advantage.

There are examples of another type where needs are so special and particular that the entire architectural approach must, for all practical purposes, start from the beginning. Such an example is Bertram Berenson's design of a home for geriatric psychotic patients. Here the requirements are such that they must be respected for what they are, without the benefit of mass purchasing, systems, or other such approaches. The personal, clinical, and social needs of these infirm and confused

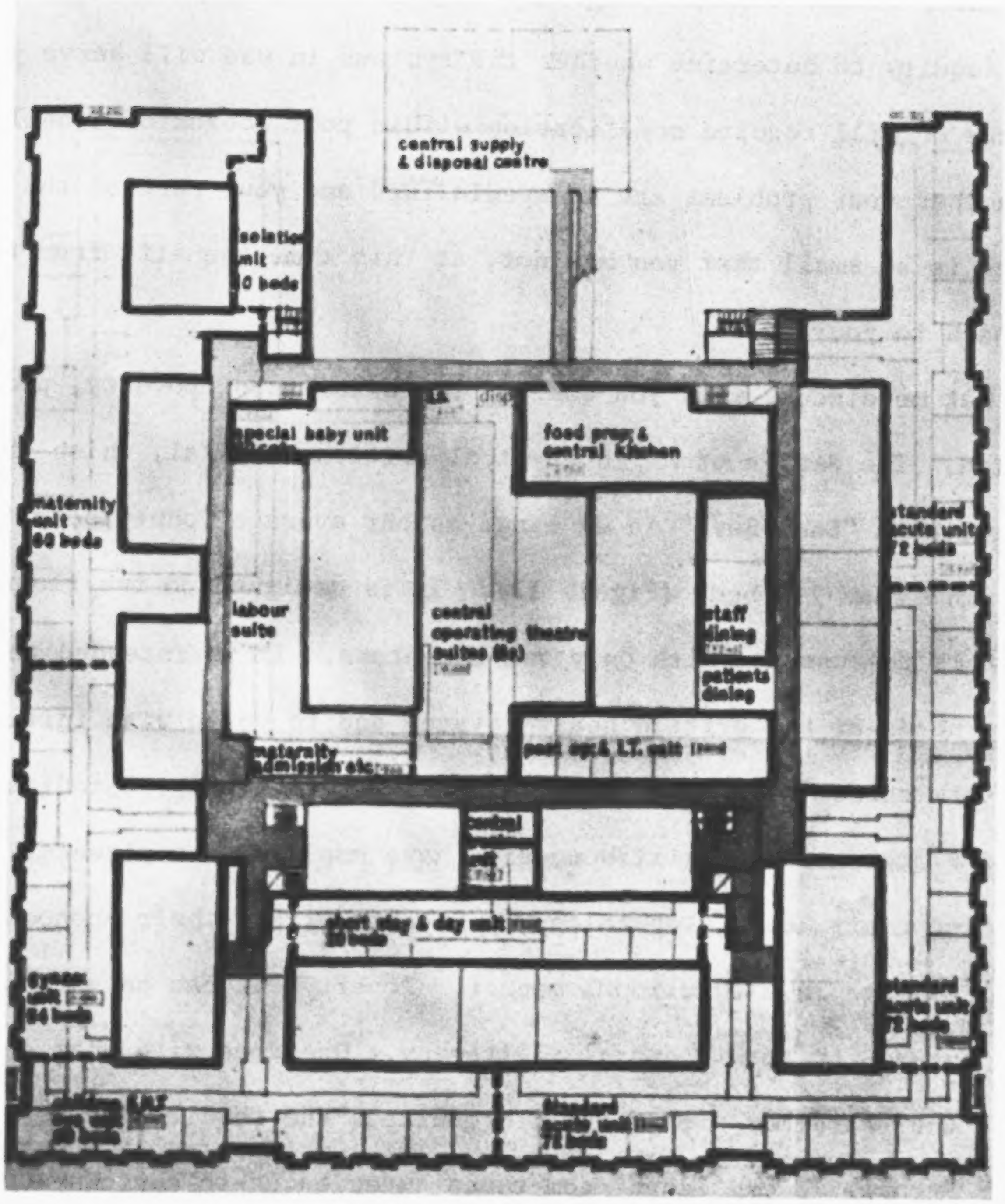

central supply
& disposal centre
isolation unit 10 beds
special baby unit
food prep. & central kitchen
maternity unit 60 beds
standard acute unit 72 beds
labour suite
central operating theatre suites
staff dining
patients dining
post op. & I.T. unit
maternity admission etc.
short stay & day unit
standard acute unit 72 beds
standard acute unit 72 beds

Figure 17. Design of a prototypical British hospital.

patients have been subjected to the most careful scrutiny and the architectural solution provided is, in my judgment, wholly justified and very imaginative. (Figure 18).

Let us now look at your own problems and your own goals. As an observer, I can visualize that your goals are in the continuity of

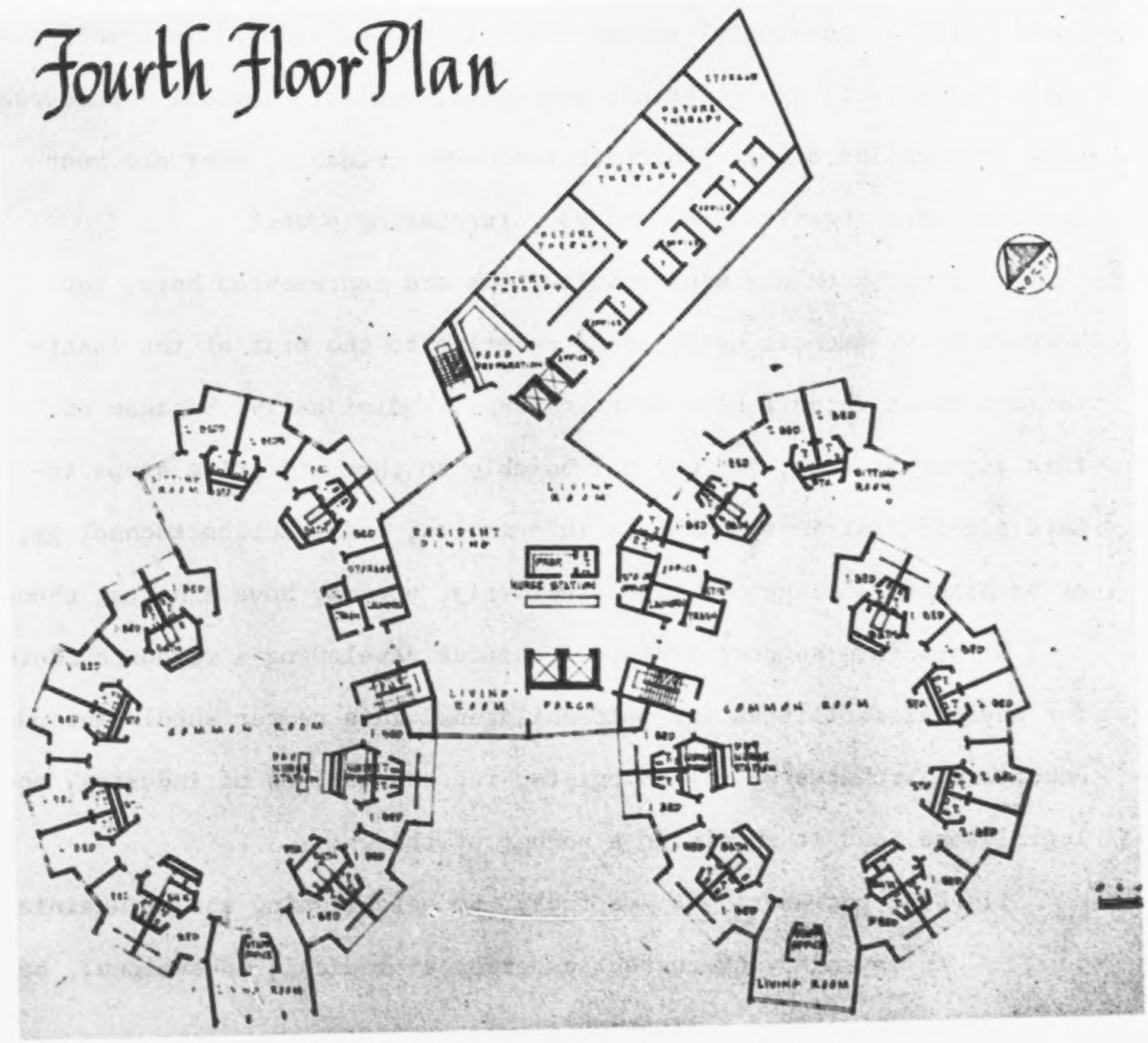

Fourth Floor Plan
STORAGE
FUTURE THERAPY
FUTURE THERAPY
FUTURE THERAPY
FUTURE THERAPY
OFFICE
FOOD PREPARATION
LIVING ROOM
RESIDENT DINING
NURSE STATION
STORAGE
OFFICE
LIVING ROOM
PORCH
COMMON ROOM
COMMON ROOM
1 BED
SITTING ROOM
LIVING ROOM
LIVING ROOM

Figure 18. Design for a home for geriatric psychotic patients.

service in the education of deaf children and in the quality of your performance.

If you wish to improve the environment for your service, it is necessary for you to assemble the resources which can give meaning to these goals. The first of these resources is technical. What, for example, do you know about the medical, audiological, and educational phenomena with which you work and which you can transmit to us, your architects, in meaningful terms? What is the behavioral information - anthropological, psychological, ecological and sociological - concerned with deaf children and with their teachers? Finally, what are your numbers, your organization, and your purchasing power?

I do not know how many institutions are represented here, but however many, each is quite small relative to the size of the institutions about which I have been talking. Individually, because of this factor of size, you may not be able to take effective steps toward significant improvement in information, construction technology, or architectural ingenuity. Collectively, you may have a better chance.

I therefore suggest that you consider developing a resource center for physical facilities for deaf children. This center should include educators, architects, psychologists, representatives of industry, and legislators, and it should do a number of things:

1. Find out where you are today, by establishing and maintaining an inventory of current experience--medical, educational, behavioral, and environmental.
2. Evaluate this information. Where there are significant conflicts in the evaluation, let the conflicts be visible so that meaningful options can be generated to respond to the needs which they generate, however diverse. Consensus may deprive you of these options.

3. Develop your architectural requirements in technical, not in spacial terms. These may be tested in a variety of design configuration--in model form or in mock-up--to determine values and, if necessary, options and alternatives.
4. Where the existing technology does not meet your needs, develop performance requirements for those components which do not meet your needs, or which, if they do meet your needs, do not fit with other components now on the market. Test out industry to determine its interest in helping you to meet your need. This failing, see if you have allies with similar needs but with greater purchasing power, which might induce industrial interest on the basis of your combined strength.
5. Maintain a continuing program of research and development in the environment for education of deaf children. The needs and technology are in flux, and only a continuing program can serve your long term needs.

And what about tomorrow? I suggest there are some conditions which you should consider within the texture of your own activity. One is the area of educational change. You may be increasingly involved with the integration of deaf children in normal schools and also with the integration of young deaf children with older ones. There may be developed better and more comprehensive diagnostic procedures which will locate more deaf children in the community and locate them earlier with added responsibility for you as specialists in their education. There may be bio-medical changes, such as more effective surgery for restoration or construction of hearing or changes in the genetic code which will alter the problem of deafness signficantly.

There is the area of social change. What happens in Watts or Harlem has its own bearing on what happens in your own areas of social and educational concern. What happens with changes in family structure, particularly where deaf children are involved, will also have its effects on what you do and how you do it.

Then, there are changes in educational technology. One may be the use of computers as a resource for the education of deaf children. Another could be significant changes in the teaching-student ratios which may derive from national or foreign experience. There may be major changes in teacher training and in the amount of educational time allotted to each deaf child. Each of these changes will modify your environmental needs. Perhaps I have made my point: that you will need a dynamic approach to architecture - one which responds to your needs in being and in change.

Finally, I have a suggestion for your next conference. Bring legislators - and legislators - and legislators.

ACKNOWLEDGEMENTS

1. Figures 11 and 12: Langley Porter Neuropsychiatric Institute, (Stone, Marraccini & Patterson and Joseph Esherick and Associates, Joint Venture Architects).
2. Slide 15: University Residential Building System, Building Systems Development, Inc., Architects.
3. Slide 16: SCSD building components, (Ezra Ehrenkrantz, Project Architect).
4. Slide 18: Preliminary studies, Weiss Building, Hebrew Home for the Aged, Philadelphia (Bertram Berenson, AIA, Consulting Architect).

TEN THOUSAND HOURS

by

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Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D.C.

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One of the pioneer professionals in the area of instructional technology, Mr. Perrin has been involved in numerous research projects in this field and has authored a large number of articles which have been published in professional journals. His professional experiences have been varied. He has directed the 1967 USC Summer Institute for Disadvantaged Youth; he has been instructor at various media institutes; in 1963-64 he was a Research Assistant for Machine Programmed Instruction; before that he was a Research Associate for the NEA Technological Development Project; and from 1954-57 he was Writer/Director of a film unit that made numerous movies in Melbourne, Australia. At the present time he is, in addition to his role at USC, a consultant to the John Tracy Clinic and to the Pilot Project at the California School for the Deaf in Riverside.

TEN THOUSAND HOURS

Under favorable circumstances we have about ten thousand hours to develop a deaf child into a functional and productive citizen.

He must learn language and communication skills, social skills, and vocational skills in a period of about ten years. All he has against him is that he starts four or five years behind in his development of language skills, lacks the primary sense for receiving outside communications, and must be capable of getting along in a world of hearing people. Added to this, he must learn a phonetic language which he will never hear. Even under optimal conditions it seems difficult for this child to be a "productive" rather than a "dependent" citizen. The exceptions are often cited to overshadow this fact. It is important in an economic sense that this child should succeed, and certainly it is possible.

Traditionally, improvement in education is confused with growth. Education has been expanded to the masses through duplication--duplication of buildings and teachers and classes. The net result is simply more of the same--without being necessarily better or worse. Combining little red schoolhouses into unified schools makes for more efficient administration, but the saving is invariably absorbed by increased costs, or non-instructional items like cafeteria and bus service. The school system, as we now know it, has a preset level of efficiency which is difficult to exceed. To raise the level of education there is no recourse but to lengthen the school day, the school year, and the number of years in school. The average student in 1968 spent four times as many hours in school as his counterpart in 1900--twice as many days, and twice as many years. This, then requires more classrooms and more teachers. The public schools are like giant learning factories, from which students are often graduated whether they learn or not. Eventually the student graduates, only to find that the "Peter Principle"[1] and automation have wreaked havoc with the job market, so that at least a bachelor's degree is needed for even a simple clerical job. Since a high school diploma is no longer adequate, emphasis moves to higher education--nineteen full-time years in school for a Ph.D. and correspondingly higher in other professions.

There are indications that limits are being reached in terms of recruitment of teachers and availability of funds. There are three million teachers in the schools and colleges with more than fifty million students. Education costs about seven percent of the gross national product.[2] Dietrich points out that instructional costs are rising while the tax base remains essentially constant.[3] The failure of bond issues, particularly in inner city areas, emphasizes the need to contain costs or to seek other sources of revenue. Some schools promoted funds from the federal government and foundations to develop innovative teaching techniques. Often large sums of this money were diverted to support housekeeping operations, like paying the superintendent's salary. The disillusionment of funding agencies when these projects failed to become self-supporting has led to restriction and tighter control. Eurich[4] from the Ford Foundation, and West[5] from the U.S. Office of Education recently outlined measures to insure some kind of dividend for the student in the classroom. Costs must now be justified in terms of improvement in instruction.

A special kind of planning is required to obtain a dollar of improvement for a dollar of investment or to achieve a continuing dividend.

Case 1: Consider a school which has no improvement money at all, 1000 students, thirty-three teachers, and the appropriate supporting staff. The budget is $600,000. One teacher leaves and is not replaced, so every teacher gets one more student and $150 to spend on additional equipment and materials. Will the school be better or worse off? Work out your own justification, then we'll compare notes.

The money could buy thirty library books, some SRA reading kits, or one or two small pieces of equipment. Pupil-teacher ratio is increased from 33:1 to 34:1. My reaction is that the pupil-teacher ratio is already so high that the few extra materials would not compensate for the added load. Buying things because the money is there means poorly planned spending and will be much less effective than spending whatever is necessary to achieve specific needs as part of a long-term program.

Case 2: A college professor is given $20,000 to develop the audiovisual program. He buys six overhead projectors, a copy machine, and materials to make overhead transparencies. He also buys a slide camera, a copy stand, and three Carousel slide projectors. The remainder of the money is spent running ten workshop sessions to which members of the faculty are invited. The materials, equipment, and consultation time are available to the faculty free of charge for one year. Make your evaluation, and we'll compare notes again.

College faculties can certainly use some audiovisuals to brighten up their lectures, but this is a shotgun approach. Will the faculty members who come be those in need of help? Will the pearls of wisdom be lost in a sea of generalities to bridge the applications to different academic disciplines? Even if ten percent of the faculty come, will one percent use the service? And at what level? I don't think the odds justify $20,000. It would be difficult enough to justify $2,000.

Case 3: Fail rate in a freshman lab class is 60%. Analysis shows the procedures outlined in the lab manual are difficult to translate into practice, and students spend much of each lab period waiting for the teaching assistant. Professor Rush decides that live demonstration for each student would be ideal, and this is best simulated by a slide-tape presentation of each experiment. There are 100 students in the lab class each semester. He is funded with $5,000 to make fifteen five-minute presentations. Comment.

Well, the project as outlined is not without holes. What improvement rate could be expected? Is the production cost realistic? Too little? Excessive? Who will supply the presentation equipment, and will it be used in the lab? Or where?

This case study is based on a real life situation, so let me quote facts. In this study the fail rate dropped from 60% to 10%. Since fifty students did not need to repeat the course next time, the class size dropped to half, teaching assistants were now freely available, and 2500 square feet of labratory space was made available for other purposes. Was the expenditure justified? The saving in space alone at $20 a square foot (an unrealistically low figure) was worth ten times the cost of the presentations. Also, a "fail" mark adds approximately $500 to the cost of a student's education. Thus, the saving in student costs would repay for the materials ten times over in two semesters. Neither of these justifications save actual dollars which can then be spent on something else, so logically it would be funded from "development" money set aside for improvement of the acedemic program. Under extreme circumstances such money could come from self-taxation to the extent of one percent of the total budget. But in recent years there have been many outside funds available for this purpose. Foundations like Ford, Carnegie, Kettering, and U.S. Steel, and the federal government through the National Defense and Education Act, the Mental Retardation Act, the Higher Education Act, the Economic Opportunities Act, Vocational Education Act, and Captioned Films for the Deaf are representative.

Existing problems in the education of the deaf justify use of such funds for developing new techniques, but random application of money is little better than no application. Dividends to be expected from investment must be specified and planned for or their achievement will be, at best, sporadic and unpredictable; at worst, impossible. Finding procedures which will assure both funds and continuing dividends is the initial problem, and there are numerous alternatives to aid in solving it.

Prescriptive Teaching

Prescription implies analysis of the learning problem, diagnosis of specific needs, and a prescription to achieve some desired outcome. The key to effective prescription lies in determining what the student already knows and what he is capable of achieving. The learning goals are established separately for each student with sub-goals to provide regular check points along the way. This learning system has two constants and one variable. The student is a known, the outcome is a known, and the instruction is the variable. The quality of the "prescription" determines the success of the outcome--unlike conventional instruction where the instruction is a constant, and the student is graded on his achievement. Prescription usually involves a team teaching approach, with a variety of learning experiences. Peter,[6] working with the handicapped child, developed the following rationale:

> It provides (educators) with a systematic approach to link medical, psychological, and social diagnoses into reasonable

> therapeutic terms applicable to the classroom....It then translates this to the teacher and others responsible for action. The specific elements of the educational program are thus related to the diagnosis. Prescriptive Teaching assembles diagnostic information in a manner that facilitates appropriate teaching, making a significant contribution to improvement of the education of disturbed and disabled children....a wide variety of educational techniques (are utilized) in the solution of the child's difficulty. This is particularly important in teaching moderately disturbed, learning disabled, or multiple-handicapped children where a number of educational variables must be modified.

Group Size

In 1958 Lloyd Trump[7] suggested a means of optimizing use of teacher skills and student time. For films, lectures, and presentations where students respond as a group, three or four classes can be combined without loss of effectiveness. The teachers thus set free can engage in small group or tutorial instruction. Trump suggests a time division of 40% large group and 40% individual study, leaving 20% for small group and tutorial activities with the teacher. The student is given materials and specific assignments to complete in his individual study time. At the same time individual instruction or tutoring is possible to an extent not allowed for in the conventional instructional pattern. It is a fact of life that much of the current so-called "group instruction" is really tutorial instruction where the remaining members of the class sit and wait. Trump's plan, with modification, would seem easily applicable to schools for the deaf. One word of caution: significant gains cannot be expected where the teacher works with the small groups in the conventional way.

Instructional Packages

For some years we have had "correlated" materials; textbooks and workbooks, textbooks with films, filmstrips, recordings, and so on. Recently there have been many marriages between publishing companies and producers of films and other audiovisual materials. It is increasingly common for such companies and for national curriculum groups to publish course materials as a package. A typical package includes films, filmstrips, records, reference books, worksheets, and realia. Variations might include 8mm film loops, tape recordings, and equipment necessary for their presentation. More than 2,000 such packages are now available, from single lessons to whole courses in reading, PSSC Physics, or foreign language. The teacher can use the package as it was designed, or select the necessary elements from the "cake mix" to achieve the desired objectives, or use the same materials with the content tailored to audience size from large group presentations to individual study.

Extensions of Man

> The spoken word was the first technology by which man was able to let go of his environment in order to grasp it in a new way...In this electric age we see ourselves being translated more and more into the form of information, moving toward technological extension of consciousness.. ..we can translate more and more of ourselves into other forms of expression that exceed ourselves. Man is a form of expression who is traditionally expected to repeat himself and echo the praise of his Creator....With the new media, however, it is possible to store and to translate everything; and, as for speed, that is no problem.[8]

McLuhan describes how man extends his senses through books, films, television, and other media. Traditionally, we repeat the same lesson many times throughout our teaching careers, and in the public schools there are over 100,000 teachers at each grade level presenting similar lessons. A medium like television allows the same lesson to be viewed. in many classrooms simultaneously, while the addition of vidiotape makes it possible to repeat that lesson at a later time. Thus, a great lecture or a great presentation need be given but once.

At Michigan State University basic courses with enrollments of several thousand are now videotaped and repeated hourly from 7 a.m. to 11 p.m. for reception in dormitories and study rooms as well as classrooms in various parts of the campus. Television sections are complemented by small group discussions once each week. With the availability of several local broadcast stations, it would be a simple matter to extend the reception area beyond the campus boundaries.

Educational broadcast stations offer courses for school and college credit, and network programs like Continental Classroom (now discontinued) had national audiences of 400,000 for which 300 institutions offered college credit. In England a non-resident university employing television is being established.

The Midwest Program for Airborne Television Instruction (MPATI) is the most ambitious project conducted at the public school level, transmitting videotaped programs from an airplane to parts of five different states in a radius of 200 miles from Montpelier, Indiana. The airborne aspect is now discontinued in favor of ground-based stations, and the surprising result of this experiment was the degree of unusual acceptance despite differences in time zones, bell schedules, and school systems from small rural districts to big cities like Chicago and Detroit.

Television is most effective when teachers decide what they want televised and receive study guides and packages of correlated materials to complement the television lesson. Initially television is an extension of the classroom, but its real potential lies in its ability to transgress time and space and break through to the world outside. We can travel to foreign lands, watch the Legislature at work, visit with Edmund Teller, John Glenn or Ray Bradbury, or project ourselves into a microscopic world or into outer space. The range of visual-sensory experiences is virtually limitless. The range and quality of program material already available is excellent. It is surprising that there is not an organization for "Captioned Television for the Deaf" selecting the best available programs and rebroadcasting them for home viewing in every major city.

Television may be used for supplemental teaching and enrichment, but low cost videotape recorders make it possible for a student to evaluate his sign language and speaking even more critically than with the conventional mirror. Television also permits remote observation of play and study areas, and classroom observation for teacher training. The John Tracy Clinic is currently making a series of teaching films using selected excerpts from hundreds of hours of videotape of tutorial instruction in speech and reading.

All audiovisual media are "extensions of man" but among the most important of recent developments is the super 8mm film in cartridge form. The cost of a film cartridge is reduced to that of an (expensive) library book, making it possible for schools to own large numbers of films for group and individual instruction. Thousands of single concept (silent) films are available with excellent potential for education of the deaf. Teachers may also produce their own films for a cost of about a dollar a minute. Riverside School for the Deaf has teachers recording their field trips on 8mm film so that language development can continue to be built around the experiences. Prescott School in Lincoln is making excellent use of 8mm sound films for use as extensions of tutorial instruction for the hard-of-hearing.

Programmed Instruction

Group learning promotes social interaction essential for the development of communication, social skills, and personality. But in academic areas tutorial instruction is most efficient since it maximizes student-teacher interaction. Socrates provided a classic model which has been mediated, with some modification, in various forms of programmed instruction. The ease of eliciting and controlling student response is illustrated in the following game:

1. Indians send signals with _ _ _ _ _.
2. A short name for Coca-Cola is _ _ _ _.
3. A funny story is often called a _ _ _ _.
4. The white of an egg is the _ _ _ _ _ _ _ _.
5. Now review your last answer. If you said albumen, you are correct.

Programmed texts are now available by the thousands, and many are listed by school systems with their "recommended texts." Reputable publishers have tested and revised their materials to achieve the predetermined outcomes, and will supply test data and samples of the pre-test and post-test to teachers on request. They also cue the teacher in which areas the program needs human assistance to bring performance up to the desired level. Teaching machines, after some initial setbacks, are not being widely adopted. Stoyanoff[9] used audiovisual machines and programs to attain a year of reading achievement in three months with poor readers in the eighth grade at Temple City, California. Jim Evans[10] in Albuquerque, and Omar Khayyam Moore, [11] at Pittsburgh used machine-assisted methods to teach reading to three-year-olds, achieving vocabularies of up to a thousand words. Postlethwait [12] at Purdue has now successfully revised his College Botany for freshman as Evan Keislar[13] did with the molecular theory of matter some years ago. The ability to program multi-sensory experience in a sequence which adapts to the skill and progress of the student has enormous potential for learning by the deaf student.

Information Systems

The computer is a device for data storage, processing, and retrieval. It is already used in some schools to print the monthly pay check, schedule teachers and classrooms, book films, keep inventories, and order new materials automatically as required. The computer also has the decision-making capabilities to assist in diagnostic teaching, counseling, and computer assisted instruction (CAI). It can be programmed to automatically modify the program on the basis of response data provided by the student.

Information systems and programmed materials can be stored in computers remote from the school building. Many schools already have computer terminals connected to local computers, and these in turn are being linked into a vast communication network where computers talk to computers, and where from any terminal we can obtain library information or take courses.

New Environments

The kinds of innovations outlined here will have a significant impact on the design of classrooms and workrooms for both teachers and students. So-called "flexible space" should be regarded with suspicion since often it reflects indecision by administrators and architects, resulting in space unsatisfactory for any learning situation. However, some trends which will affect environment environment are highly predictable.

More space will be needed for individualized instruction. Added to this must be conduits for computer and television cable, more power circuits, increased ventilation or air conditioning, and accoustical treatment with isolation of noise-producing machinery.

Other aspects of the learning environment have been treated in more detail by other speakers at the conference.

Production of Materials

Teachers should preview and utilize as many of the commercially available materials as possible, but the special needs of deaf students will require a substantial level of teacher production. Essential skills in this area include:

1. writing objectives in behavioral form
2. production of programmed instruction materials
3. storyboarding the recording of audio tapes
4. the producing of simple graphic materials, overhead transparencies, 2 x 2 color slides, and super 8mm single concept films, and
5. the testing and evaluating of materials in the classroom.

If the list is somewhat frightening, it is becuase of unfamiliarity. Inservice training can introduce these skills over a one- or two-year period. The success of Bob Lennan's project for the neurologically handicapped deaf at the California School for the Deaf at Riverside is due in no small measure to the ability of the teachers to produce their own materials.

The key to effective "individualized" instruction lies in the prescription of materials designed to achieve specific outcomes and more or less "programmed" to maximize student participation, interaction, and response. Many of the media packages currently available are excellent for this purpose; yet those developed by teachers to meet their own needs tend to be even more effective.

Cost/effectiveness strategies should be used in their production. Highest priority should be given to those which can be:

a. most rapidly produced to achieve the

b. greatest effect with the

c. largest possible number of students.

Once validated, these materials should be shared with other teachers or better, published and distributed by a central agency like Captioned Films for the Deaf. This agency could also publish a quarterly register of "projects in progress" to reduce duplication of effort. If every teacher of the deaf produced one small package each year, we would soon have a sizable store of materials for individualizing instruction.

Teachers need time outside the classroom to produce materials. By using a modified Trump plan the teacher's classroom time could be reduced to 3½ days a week, allowing time for producing materials and attending outside meetings. This could be accomplished by organizing "cells" of four classes for large group sessions for two fifty-minute periods each day under the care of a single teacher, while conducting the remaining sessions in regular-size groups. This should give each teacher six and one-quarter hours of preparation time each week. If additional help is needed, parents or para-professional personnel should be enlisted.

In conclusion, it should be pointed out that the kind of ad hoc approach which permits the teacher in the traditional classroom to survive from one crisis to the next does not belong in a school for the deaf. The student need is so crucial that optimum use must be made of student time and teacher effort. A learning team, using prescriptive techniques and validated materials, presents the only logical solution. By minimizing the present duplication of effort, maximizing personal help, and extending learning beyond the present school day, significantly greater learning can be expected.

We have just ten thousand hours to develop a deaf child into a productive citizen.

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CONFERENCE SUMMARY

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Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

CONFERENCE SUMMARY

I would like to make this suggestion as a summary statement: Dr. Stepp's organization here is obviously an extremely productive and useful organization with great impact. From what I have been able to determine from conversation with some of you, there should be a way, consequently, to involve these media centers, one or all, as clearing houses for the kinds of information that lends itself to a definitive way of studying, evaluating and making decisions about what environment ought to be. As I and some of the other architects here anticipated, we were approached by some of you and asked: What should we do? Can you send us guidelines for a building we are about ready to launch? I don't know what the others answered. My answer was, "I don't have guidelines to send you. I wish I did." This indicates to me the necessity for developing a resource center, and I would suggest at this point that it be in association with an organization such as the Midwest Regional Media Center for the Deaf which would apply its energies to the development of this information in a systematic and organized way.

Also, whether it is this center, or another one, or many centers, we should still continue to test, evaluate, reconsider, and invent all of our points of decisions. Again, I believe others have suggested this too. It was pointed out to me, and justifiably, some of the errors I had made in conceptualizing some of my work, and I think some of the architects here who brought their work perhaps feel that there were things that they overlooked. There are things that could be refined or defined, and if this is the case, then a center such as the one I am suggesting, could, I think, be of enormous value. Keeping in mind that other organizations working with and for handicapped children are involved in similar activities, it would seem to me that a coordinated effort would make their work and your work much more useful. I would think, too, that the only way we can prepare for change, and I think that we would all agree change is inevitable, would be to have a resource center for environmental information that would allow us to make the difficult transition from the now to tomorrow, to five years or 10 or 20 years from now. We will, I am convinced, through this effort prevent errors in judgement, some premeditated, and hopefully, most of them not premeditated, that could occur and could cause great difficulty.

So I would say it this way: this device for exchange, for interaction on a real level, with a real problem as exhibited through this meeting and its organization which has been superb gives the architect, the educator, and the specialists associated with each of these professions, a chance to begin to find out what each other's problems are. Now, it seems to me, a broad baseline has been drawn and perhaps the beginning of a language of mutual understanding has been developed. It is essential that this be carried on. I would like to volunteer my services to help with this project. Again I reiterate that you are the decision makers and it is going to be you who do it, if you think that this is a worthy idea. I don't know that it is either reasonable or timely to say more about a meeting during which so much information was exchanged, other than to thank you very much for your consideration and, I think, your honesty in reacting to, not just my own point of view but the points of view of others. I sincerely hope that we will meet again.

REPORT FROM CAPTIONED FILMS FOR THE DEAF

by

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Paper prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

REPORT FROM CAPTIONED FILMS FOR THE DEAF

Being assigned to make some report on the Media Services and Captioned Films Programs, I shall try to do that briefly. Last year, when we had the Symposium, I was privileged to give a short greeting and then had to depart almost immediately to get a plane back to Washington D. C. because of a budget crisis.

Up until the 1967 session of Congress, the Captioned Films program had been in what is termed the Salaries and Expenses budget of the Office of Education. This is the money that is allocated by Congress to operate the office, to pay salaries, travel, conference costs, consultants, and things of this nature. It so happened that in the tremendous growth of the office and the number of demands that were made by the President for various kinds of conferences and crash programs, the "business management" found that they were a million dollars short. Captioned Films had about $700,000 left for the last quarter of our operations. My rush home was to defend that, but it wasn't completely successful. We were very substantially reduced.

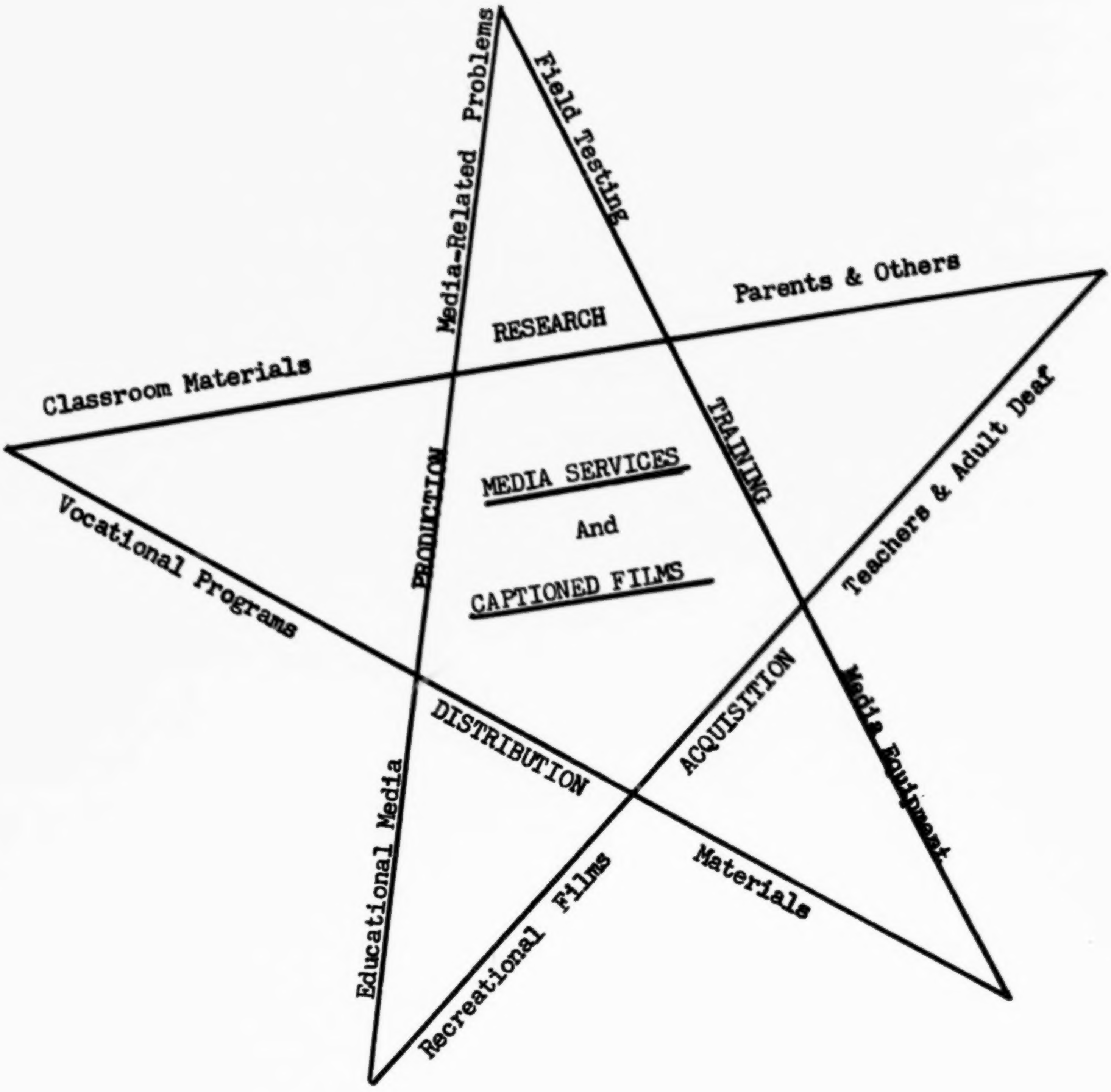
I mention that not as a matter of complaint, but only to justify or rather explain why some of the things that we have talked of developing have not eventuated at this point. We were held back on printing the motion pictures for the lipreading instruction developed by Dr. Withrow's project and later modified and put into cartridge form for teaching basic primary vocabulary. These will be available by the end of the school year, although not to everyone of the 700 schools and classes in the country. There are 75 cartridges for individualized lipreading instruction. As I said, this distribution was held up, but we are about to catch up. The situation was further compounded by the fact that the administration has had very strict limitations on what we might go ahead and do. In other words, we were able to fund existing projects that were established, but we've not been able to make new starts on anything until just recently. So you might say that since last April, we've almost been out of business except for what has been going on principally through our Regional Centers. We hope to pick up momentum again.

Before going further about the program, I'd like to digress for a moment. Having mentioned the Centers and what they have been doing, I would like to pay particular tribute to the Center here at Nebraska for the fine work that it does throughout the year and particularly for the excellent work that Dr. Stepp and his staff have done in bringing off this Fourth Symposium. When we first talked about Symposia, I wasn't sure whether we wanted to get involved on an annual schedule. As Dr. Stepp indicated earlier, these Symposia are funded on an annual basis, but each one of them seems to come off a little better than the previous one. I think with the kinds of problems that we have and the growing identification of needs that arise out of such meetings, we probably shall be coming back to Nebraska for a long time to come. It is certainly a pleasant place to visit.

May I also thank, not only the Center and the staff and the University, but the participants who prepared papers and demonstrations for this meeting. I hope there will be some sense of reward in what you've done, in the kind of questions you've stimulated, and in the fact that the papers will be published in the American Annals of the Deaf. It seems especially significant that we have architects and school administrators here together and that the flexibility suggested for school rooms or school buildings of the future is equalled by the flexibility that we have seen in the people who have talked together here. This is certainly important.

Now a few words about our programs for the benefit of the architects who probably never heard of Captioned Films before they came to this meeting and still may not know quite what it means. Perhaps this transparency (See Figure 1.) will illustrate the various facets of the Media Services and Captioned Films Program. Let's begin with our acquisition program. The acquisition section is headed by Mac Norwood. Something was expressed yesterday in one of the papers--an excellent paper by the way--to the effect that deaf people don't want to think for themselves, they don't want to learn, and so forth. It seemed rather negative in its estimate of deaf people. You have seen George Propp operate and would recognize in a moment that he is a deaf person who does not conform to that kind of an estimate. I could point out many similar deaf people. The thing that brought this to mind is that our acquisition program in the office is handled by a deaf man, Mac Norwood. He does an outstanding job. I mention this not to pick a quarrel with the person who made the statement, but rather to emphasize the fact that there is no stereotype of the deaf and that we need to look at them as individuals. This is true of all kinds of handicapped people. We need to see them first as people and second as handicapped.

In acquisition, we have actively dealt with hardware and software, and I'd like to report to you people who are heads of schools that, through our distribution contract under Howard Quigley's direction, we


Media-Related Problems
Field Testing
Parents & Others
RESEARCH
Classroom Materials
TRAINING
Teachers & Adult Deaf
PRODUCTION
MEDIA SERVICES
And
CAPTIONED FILMS
Vocational Programs
ACQUISITION
Media Equipment
DISTRIBUTION
Educational Media
Recreational Films
Materials

hopefully will be ordering enough overhead projectors, filmstrip projectors, screens and tables so that there will be one of each of these in every classroom for the deaf in the United States. We are ordering about 3,000 extra acetate rolls. Equipping classes has not all been done by Captioned Films. Actually, Public Law 89-313 has supplied more funding to state supported schools than we do. Our ratio would be about $50 per capita as against more than $200 per capita from that other source. In short, a great deal of this equipment has been bought with federal funds other than ours, but I think that to a considerable extent we started the trend. We are trying now to complete that job.

Another part of this program is training and in that, we are trying to assist both in-service and pre-service training. With Dr. Stepp, this week, we have had a preliminary meeting of some of the teacher trainers and hope to begin to involve them in more use of media in the training of teachers of the deaf. Eventually, that will spread all over so that, as new teachers come out of training, they will be better equipped than they are now to utilize the media that they are beginning to encounter in the classroom.

The other aspect of training is continuing education. This refers to training prospects or possibilities for the adult deaf. We're not much involved in this as yet. About the only thing I can really point to is that at the present time in Baltimore they are using film lessons that we have developed for the adult deaf in keypuch and typing. The adult deaf are carrying on an adult program there for upgrading their skills and getting to a level where they might get better jobs. We hope to expand this kind of effort.

The distribution aspect of the program, is under Mr. Edward

Carney's surveillance. Distribution goes to both deaf children and to deaf adults through recreational films that are distributed through White Plains, New York, Indianapolis, and Colorado Springs. Our total population served is estimated at 200-250 thousand.

The research aspect of the program is not extensive. We are really doing research and development and this is not a large part of our program. In this area, one of the most significant projects that we are involved in is the development of what we hope will be a multimedia package in language instruction. This includes instruction for beginning deaf children who are at reading readiness age. At present we have enough for about 30 hours of such instruction on filmstrip. It will be in field testing by the end of this month. If this works out as well as it seems to in the development stage that it has been going through for some three years, it could make a significant difference in the rate at which deaf children begin to learn to read. This again is not the whole story, by any means, of the development of language, but it is something that is structured and will go along with other unstructured kinds of experiences we saw in Dr. Leitman's film.

As we talk about the education of the deaf children, I think that we need to bear in mind the fact that being busily engaged in activities of one kind or another does not necessarily develop language. There must be some input of language if we are going to get any out. Language must be cranked in as part of any on-going activity. Language doesn't take place spontaneously with deaf children in anything like the way that it does with hearing children who are chatting and conversing. Well, at any rate we are endeavoring to develop some structured materials that will be supportive perhaps to other kinds of language and group activities in the school.

With regard to production, we are doing certain types of in-house production, principally filmstrips. You who have been receiving Captioned Films output know of the auditory training materials and some of the other things that we have been releasing. When I say "in-house" I mean this is supervised within our own staff although done by professional companies. And finally, we have extramural productions such as those that are going on here at the University of Nebraska in the form of lipreading films, or with Dr. Wyman in the form of transparencies and perhaps soon with Dr. Jackson on the development of teacher-training materials and so on. Rather than enumerate a list of the things that we have been involved in this year, may I mention an item or two that you may be looking forward to. I've referred to the lipreading films. These will be on super 8 sound film for use in the Technicolor 1000 projector. I believe the projectors have already come in. We have a hundred of them for loan and we'll be ordering another hundred soon. I venture to predict that before too long, 3-5 years, virtually everything that we have and most of the things that you have will be on 8mm film. We're moving rapidly in that directon. It's easier to use, somewhat cheaper, and has good quality picture and sound for the size of groups that we normally have. The Technicolor 1000 retails at about $300.00 and in quantity should be a good deal less than that.

There is already beginning to be some variety of material available for this projection system. For example, the ten films on language teaching that we produced through United World Films are now available in cartridges which can be bought commercially. At this point, they are close to the price of a 16mm film because the cartridge itself costs something. We can foresee, however, that these are going to come down in price. We will be supplying some of these things to you on the usual free loan basis.

We have just begun to receive from the John Tracy Clinic the start of some films on teaching speech. This is to be a whole series of films produced first on video tape. Transfers to regular 16mm film are being made, and these will be broken into cartridges. With these, teacher-trainees will be able to use audio tapes for listening to imperfect speech and then see pictures of expert teachers of the deaf actually working at correcting this speech or developing new speech skills. This will be a multi-media package of workbook, tapes, and film.

We have going in California the development of a program for teaching electronic assembly. This is designed for the rather slow deaf person. It is scheduled to be ready for the next fiscal year. Things like this that are programmed carefully take a great deal of time to develop. Unfortunately, the people who know something about programming and who can be drawn into the area of the deaf are a rather scarce commodity. Recognizing that, our Southwest Regional Media Center is planning a workshop this summer for teams of people--a supervising teacher and a classroom teacher in the same department from a number of schools--to get together nnd spend some weeks working with expert programmers, people who are good in theory as well as the practice. Through this approach we may begin to develop a cadre of people who will spread basic knowledge about how we can go at programming materials for deaf children.

Well, we have many many balls in the air these days. If I keep juggling them here, I shall probably drop some so maybe this would be a good time to stop. Let me say that we are delighted that you all came. I trust that we may be able to implement the suggestion made a little while ago that we do some follow-up on this conference to provide specifics that people might be able to use in developing new facilities for deaf children.

DISCUSSION SUMMARY

by

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Summary prepared for Symposium on Research and Utilization of Educational Media for Teaching the Deaf, February 5-7, 1968, Lincoln, Nebraska.

Sponsored by the Department of Educational Administration, Teachers College, University of Nebraska, and Captioned Films for the Deaf, U.S. Office of Education, Department of Health, Education and Welfare, Washington, D. C.

George Propp, Regional Coordinator and Administrative Assistant for the Midwest Regional Media Center for the Deaf, is a graduate of the Nebraska School for the Deaf. Mr. Propp obtained his B.A. and M.A. from the University of Omaha, and more recently received an M.A. in Educational Administration from San Fernando Valley State College as a participant in the Leadership Training Program in the Area of the Deaf. He is currently a doctoral candidate at the University of Nebraska.

Mr. Propp has been a teacher of the deaf for nearly twenty years, all at the Nebraska School for the Deaf. In addition to his high school teaching duties, which covered several subject areas, he was also varsity athletic coach.

Formerly editor of the NSD school paper and a member of the editoral staff of the Deaf American, Mr. Propp has written many articles of a journalistic nature. He is a member of several professional organizations, a Board Member of the National Association of the Deaf, and Publicity Director for the World Games for the Deaf Committee of the American Athletic Association of the Deaf.

DISCUSSION SUMMARY

Introduction

Two of the premises upon which the Fourth Annual Nebraska Symposium was based were (1) architecture to a considerable extent shapes the activities which take place within the learning environment and (2) because of very limited communication between the two disciplines, the profession of architecture has not made an optimum contribution to the profession of education of the deaf. In this summary chapter an attempt will be made to enumerate some of the gains obtained from this initial group effort at interdisciplinary communication.

It is not the purpose of this chapter to review or summarize the various papers and presentations contained in the previous sections of this report. The objective of this chapter is to attempt to chronicle some of the thinking that was expressed by various participants in response to the challenge of providing a better learning environment for educating deaf children. Most of the material in this section was collected from recorder notes, summary sheets, and from informal discussion in the lobby and at the luncheon tables. In dealing with some of the questions, we will, of course, touch upon and reemphasize some of the points made in the various papers and presentations.

The Classroom Needs of the Deaf Learner

The needs of the deaf learner in relation to classroom space must be viewed from a dual perspective. The needs are both qualitative and quantitative. While the Symposium was primarily concerned with the qualitative aspects, some discussion of the quantitative problems seems appropriate.

Dr. Powrie V. Doctor, in his introductory remarks, stated that recently tabulated figures in the American Annals of the Deaf indicate enrollment in schools and classes for the deaf has increased by 2,500 during the past year. Over a five-year span the increase has been 9,000. These figures indicate that, over the past five years, nearly 1,000 new classrooms were needed simply to take care of increased enrollment. In addition obsolescent learning spaces needed to be modified or replaced. These figures combined with a trend toward preschool education and a continuing influx of rubella babies during the next few years indicate that the profession of educating the hearing handicapped has a sufficient volume of business to demand greater attention from the architectural profession. The problem of getting architects to look at the needs of the educators of the deaf would be solved to some extent by Mr. Agron's suggestion that the profession needs to pool its purchasing power.

As stated previously, the focus of attention during the Symposium was on the qualitative aspects of the learning module. Emerging from the presented papers and the ensuing discussions were many new concepts relating to the learning spaces for the deaf student. Never before in a conference of this nature has so much respect been shown for the learner. The new classroom will be designed to permit new programs and more meaningful learning activities. Independent study will harmonize with group interaction and new instructional strategy and materials, and the deaf child will, hopefully, be enabled to achieve his full educational potential. Search for meaning will replace rote learning and the increased sense of personal worth that results will make the hearing-impaired child a more fertile candidate for the spontaneous development of language.

Standardized classrooms severely restrict the activities of the deaf child; hence, restrict his learning. This comes about possibly because we build for 50 years and plan for five or ten. As a result, most of the instruction in the education of the deaf takes place in learning facilities that are outmoded in design. However, at this point it might be stipulated that neither buildings nor programs are a panacea and that individual relationships between the pupil and the teacher are still the most important thing. Also it should be added that new prescriptions for classrooms will require new prescriptions for teacher training.

Problems of General Design

It was assumed at the outset that architecture for schools for the deaf encompassed all the problems of architecture in regular schools. Factors of geology, site, topography, and things like that have an effect on design regardless of whether the school is for deaf or for hearing children. Emphasis in this conference was on the points where there is a difference. Some of the misconceptions that architects have been working with were illustrated by one of the speakers who noted that a philanthropist donated land near a jet port upon which to build a school for the deaf. His rational was that the noise would not bother deaf kids.

Architecture is perhaps not an exact science, but it is comparable to medicine and probably more advanced professionally than is education. Information received from the educator will determine how well the architect designs. Mr. Agron suggested that educators of the deaf should pool their professional vocabulary and pass it on to the architect. We must approach the problems of construction and design with a systems management. Architects suggested, that by developing an information pool and by designing composite systems, administrators of schools for the deaf could get a great deal more for their construction money.

In designing instructional facilities, one of the difficulties is that there is generally more than one solution to a problem, sometimes as many as twenty, and frequently the solution of one problem accentuates or aggravates another. For example, to improve acoustics and noise control we must decrease mass which subsequently reduces flexibility. Before designing a building we must consider all the factors and state the important variables. While developing learning spaces for the present, we must try to anticipate the future.

Flexibility

"Much of the shouting about flexibility", said one of the participants, "is an admission of our inadequacy in planning for the future." This may be true to some extent, but must be tempered with the realization that we are in a profession where change is constant and where rapid evolution is the anticipated order of things. A great deal of interest and discussion centered around Dr. Berenson's suggestion that some day we will have buildings with disposable components which can be changed as the need arises.

We need to develop a team approach to designing facilities--a team of not only architect and administrator, but teachers, media specialists, and all the way down to the janitor. We need a good analysis of what needs to be done before building. To do this,a manual with all the specifications of designing for the deaf would be beneficial. This perhaps would come from a resource center where educators of the deaf would pool their information,and where problems could be taken and solutions sought. Many of the problems in the education of the deaf, it is frequently reiterated, need to be researched. We must question the life and activity of the "true" human beings we are designing for, not the "average."

A problem involving considerable thought and discussion was designing facilities for programs not yet in existence. The advice of the architects was that we should proceed as if they were in existence. We can't design a building based on what we don't know, but we must permeate the unknown with sound judgement.

One of the facets of school designing that was touched upon again and again was the fact that learning spaces are designed by adults and too often the structure is oriented toward the needs of the teacher instead of the learner. We do not, as one participant pointed out, really know how a child perceives space. An architect can blindfold himself and "see" how a blind person perceives space; however, he can not reduce his size to simulate the viewpoint of a child. For example, does a standard classroom appear twice as large to a five year old as it does to his 14 year old brother?

Although the conference focused on classroom spaces, some suggestions were made that could apply to related facilities in a residential school for the deaf. Mr. Agron particularly made some suggestions which should be applied to dormitory planning. He stated that dorms are generally built upon the misconception that people come in matched pairs. Rooms should be flexible enough so that they can accomodate 1, 2, 3, 4, or 6 students, with each having enough private space.

In this connection, one of the participants raised the interesting question of whether it would be desirable to have living space in schools superior to that which the child has at home. This, according to the designers, was a variable that should be researched and the information should be added to the vocabulary pool which educators would pass on to the architects.

Designing the Classroom

In designing the classroom the major concern should be to develop learning spaces that will accomodate many of today's teaching innovations for which there is little or no precedent. The activity method of learning, so vividly portrayed by Dr. Leitman, requires an entirely different physical environment than the "standard" classroom. Media and all the aspects of visual education also requires architectural consideration. This is in addition to all the other learning peculiarities of the deaf child.

Ideally, we should attempt to get away from the general classroom, the egg-crate approach, and each room should be specifically designed for the activities that will take place in the room. Since these activities will constantly undergo change, the major requisite of a modern learning space should be flexibility. Flexibility, however, means many things to different people. To the people in the State Capitol it probably suggests extravagance. To some of our educators it is little more than a cosmetic feature. However, Dr. Berenson's suggestion that we build for five years instead of 50 makes a great deal of sense. This may not be flexibility in the sense of being capable of being adapted, modified, or molded, but it is flexibility in the sense of having a learning environment that remains compatible with the changing needs of the learner.

The designs displayed by the architecture students of the University of Nebraska served to emphasize the importance of administrative decisions. The fifteen projects, all designed from the same educational specifications, offered a wide variety of solutions. The administrator must make the final decisions on the great many options open to him. These decisions should generally be made in the direction of overdesign.

Contributing to the problems of designing an optimal learning environment for hearing-handicapped children is the fact that educators of the deaf are seeking new directions and new horizons. The climate was never more favorable for instructional change, but we are in a state of transition and don't know exactly what direction things are going to take. We know, for example, that eventually ITV will have a major role in our instructional process, but we are not sure of the nature of its use. The requisites of a good classroom can't be specified and made explicit until the activities are delineated. We do, however, know some of the needs of classroom spaces and we realize that we need to escape from the traditional concept of a general purpose room. Design of a modern classroom should consider the following:

1. A large room--900 sq. ft.
2. A large display area
3. Bulletin boards close to the teaching area
4. Avoid fixed teaching stations
5. Need for floor and bench space
6. Libraries for each classroom
7. A set-up where there is no need to put equipment away
8. Overhead projector set into tables
9. Teachers have complete environmental control
10. Central control panel on teacher's desk

Also it was determined that interiors of classrooms should allow for the discovery method of learning. Words have meaning only when they are connected with learner experiences.

Some of the discussions reinforced statements that were made at last year's Symposium. At that time Dr. Meierhenry mentioned that, "Education does not occur only in the classroom or media center, but learning takes place anyplace, such as inside and outside the classroom, in the neighborhood, and in the world at large." In consideration of this, there was considerable interest in such things as outdoor nature areas, a pond on the school grounds, and so forth. This same thinking opposed the concept of windowless classrooms. It is granted that windowless rooms offer certain advantages, but many of the participants opposed the principle of further restricting the deaf child's environment by closing him off from outside spaces.

Another concept emphasized again and again was that the needs of the learning space should not be determined without involving the subject-matter teacher. The environment should permit a creative extension of the teacher, but we should not confuse teaching subject matter with teaching children.

Another thing on which there was almost unanious agreement was that the needs of hard-of-hearing children are significantly different than the needs of profoundly deaf children.

Many of the participants noted that in classroom design the student architects were trying to enclose three different types of learning activities---teacher presentation, group activities, and independent study. One of the participants made a comment that may be worth repeating: "What is the advantage of having three types of learning situations in each classroom over having the children move to different classrooms for different types of situations?"

The multi-media demonstration by Ray Stevens and Richard Meisegeier emphasized the need of incorporating media capabilities into school room design. Visual instruction for the deaf child is too important to operate on a makeshift basis. It was also apparent to Symposium participants that classrooms presently on the drawing boards should include capabilities for operation of instructional television. Dr. Jackson's demonstration of TV equipment strongly emphasized that ITV is ready to become functional in the classroom for the deaf.

As in total design, the shape of the classroom is dependent upon other variables. A round perimeter is the most efficient space enclosure theoretically. However, fixtures, furniture, and equipment generally are not designed for curved areas, so whatever economy is gained by circular space enclosure is lost by the necessity of customizing contents of the room.

Design for Hearing

Considerable attention was focused on the necessity of fully utilizing the residual hearing of the deaf child. A favorable environment can make it possible to use limited hearing with educational success. Furthermore, in addition to developing his hearing capabilities for learning in school, we are developing a communication mode which will serve the deaf child all his life. To accomplish this objective requires concentration on two distinct problems: (1) the amplification of desired signals and (2) the reduction or elimination of unwanted (ambient) noise.

Amplification: Technically, the amplification of sound is an area in which there has been vast progress during the past decade or so. On closer look, however, it is apparent that electronic progress has not been able to overcome the amplification needs of the hearing handicapped. The problems are created by two basic conditions: (1) it is important that the child remain untethered and (2) the electronic pickup should, for maximum efficiency, be as close to the source of sound as possible. The amplification technique that meets one condition fails to meet the other. To solve the problem for both these characteristics is what creates the problem. Personal hearing aids, for example, provide for maximum mobility, but at the same time pickup is usually not close enough to the signal source to be efficient. Hard-wire amplification enables us to meet the proximity-to-signal condition, but both the student and teacher are fixed to immovable microphones.

Hence, no matter how one goes about it, the best possible amplification system probably involves a combination of personal hearing aids and hard-wire devices. The induction-loop systems are such a compromise, but educators present report a very troublesom problem with "spillover." Spillover, according to Dr. Hirsh and Dr. Niemoeller, is something that we can solve, but not in a practical or economical manner. Radio frequency systems would overcome this problem but would at the same time create new problems, particularly that of attuning a child to a single room, thus again restricting his mobility.

Apparently, the ideal amplification system is not yet marketed. Research at CID, according to Dr. Niemoeller, is coming up with evidence that there is a rational solution to the problem, and in the not too distant future we will have amplification systems that more nearly approximate the ideal than those we have today. This system will not restrict the student's mobility and will at the same time provide maximum source-to-receiver efficiency.

For the administrator or teacher interested in problems of amplification Dr. Hirsh recommended the Daniel Ling articles published in various professional journals.

Acoustics: This is the term applied to architectural treatment for the reduction of ambient noise. The problem of acoustics is an area in which educational facilities for the deaf will have the greatest concentration of design effort. The acoustic properties of modern construction materials are well known, and it is possible to design facilities with sufficiently reduced noise levels at realistic cost. Selection of the site is an important first step in building classrooms for the deaf. For example, a highway at 500 feet will generate about 70 dB of noise. A standard wall will reduce this by 25-30 dB, permitting 40-45 dB to enter the classroom. Mr. Clouser stressed that ambient noise above 30 dB is distracting.

The modern building trend toward flexibility runs counter to acoustic needs. Mass is and perhaps always will be the major solution to noise transmission. Flexibility, on the other hand, is the antithesis of mass. Portable walls, for example, have distinct shortcomings as they lack mass and other qualities necessary for reduction of ambient noise.

For noise generated within the classroom, the most practical solution is to reduce the production of noise. Carpeting has gone a long way in reducing unwanted noise. Some participants raised the question of reducing noise generated by audiovisual equipment. Quieter equipment, Dr. Niemoeller suggested, would be engineered if we are willing to pay for it.

A great deal of discussion revolved around the problem of acoustics. One of the participants raised the question of whether or not this could be overdone to the extent of creating an atmosphere that is too sterile for learning. Dr. Niemoeller stated that in consideration of the fact that acoustic treatment is costly, he did not think you could carry it this far.

Windowless classrooms were again discussed because of their favorable acoustic properties. The acoustic disadvantage of windows must be weighted against the learning disadvantages, and must be made to relate to the activities that take place within the room.

Lighting

For the classroom for the deaf it has been customary for educators to specify 150 foot candles for the classroom for the deaf. Dr. Blackwell stressed that candlepower may be an obsolete tool for measuring light. He suggested that how light is used and how it affects the immediate environment is more important than candlepower.

Cool versus warm light, according to some of the comment sheets, may be more significant in the education of the deaf than is generally supposed and some research was advocated in this are.

The problem of lighting systems creating interference in amplification systems is one that can easily be eliminated through the cooperation of lighting and sound engineers.

Related to light, of course, is the phenomena of color. Little is known about the exact characteristics of color in the classroom beyond the fact that some colors create a more favorable learning reaction than others. For visibility purposes, contrast is a vastly overlooked characteristic. With chalkboards, for example, the contrast with the surrounding area is as important as the contrast with the chalk.

On the whole, discussion of lighting suggested that lighting engineers can provide lighting to meet any educational specifications. It is, it seems, a problem for educators to determine what the needs are. Again we have a problem where research is needed before we can write the necessary specifications.

Furnishings in the Learning Module

Four walls and a chalkboard do not a classroom make. This statement, as well as any, sums up the lesson impressed upon most of the Symposium participants. Architects were unanimous in their agreement that to design a learning space they must have detailed information as to the type and nature of activities that are going to take place within the facility. Various papers and presentations emphasized the fact that in seeking new directions and new horizons in the education of the deaf, we are becoming more and more involved in multi-media presentation of information to the learner. Emerging from the symposium was the concept of a classroom that provides adequately for three distinct types of learning activities--presentation, group activities, and independent study--with appropriate furnishings, fixtures, and equipment in each area. Different age groups, different subjects, different students, different teachers and different instructional strategies will all have different needs. Classrooms of standard design cannot meet the varying needs nor can standard furnishings. Accepting this dictum then raises the question of providing sufficient flexibility to accomodate activities that change from period to period, from day to day, and from year to year.

The symposium very carefully steered away from the temptation to develop a "model" classroom. Each classroom should be unique to the purposes it is designed to serve, although learning modules in the education of the deaf would have some common features. In educating the deaf growing emphasis is being placed on visual presentation, and such proven features as the overhead projector, filmstrip projector, and other audiovisual devices should not operate out of make-shift arrangements. The demonstration of Meisegeier and Stevens indicated some of the problems that arise from multi-media use in traditional classrooms. The major criticism of the procedure demonstrated was that there was too much moving around; thus, creating a problem of visual focus. The suggestion of one participant that each classroom have a slanted projection wall made a great deal of sense, and most architects present agreed that proper design could greatly facilitate and enhance visual presentation of the kind demonstrated by Meisegeier and Stevens and Perrin.

Dr. Berenson's discussion of disposable furniture elicited a very favorable reaction from many of the symposium participants. Questioning of Dr. Berenson revealed the fact that he had personally designed the cheap, disposable furniture shown in his slide presentation. He informed participants that the furniture will be marketed as soon as he can find a manufacturer who will not exploit the idea for profit.

Dr. William Jackson's display and demonstration of videotape equipment evoked a great deal of interest. Hardly anyone will dispute the evidence that ITV will play an important role in future educational developments in the area of the deaf. Any classroom facilities in the design stage at this time should incorporate such features that would make adoption of school-wide ITV a practical reality on short notice and at small additional cost. According to present technology a school, in addition to the equipment, would need a control center and cable outlets in each classroom. The classroom would need only two wall-mounted jacks--one for the monitor and one for transmitting televised pictures from the classroom camera to the master control. Aside from the versatility of the TV medium in developing new educational programs, the videotape system would permit the broadcasting of standard slides, filmstrips, and movies into the classroom over the TV cable, thus eliminating what is called "electronics clutter."

Increasing stress on individualized study also creates problems for the designer of classrooms for the deaf. Single concept films, teaching machines, and various other apparatus for independent study emphasized the need of each student to have his private learning space in the form of an adequately wired carrel. These would have to be placed to avoid both visual and auditory interference with other classroom activities.

The classrooms designed by the archetecture students of the University of Nebraska revealed several original concepts in classroom accessories. An example was a three-sided revolving pillar for display purposes. Another student proposed an outdoor nature area for each classroom. Numerous special use areas within the proposed elementary school facility emphasized the important assumption that not all learning takes place within the classroom.

Many solutions were proposed, many questions were raised, and the aspirations of educators of the deaf were considerably clarified. To make our dreams a reality the respective professions of architecture and education of the deaf must communicate. "Architects," according to Don Perrin, "must sit-in with educators to produce the type of buildings needed to educate deaf children." This, it was pointed out, is easier said than done. Within our own field there are so many problems that are unresolved, so many theories that have not been researched, so many people that are inarticulate in the needs of the learner. We need to involve all teachers, all members of our profession in the task of resolving our educational problems. From communication within our own discipline will come the vocabulary pool with which we talk with architects.

Conclusion

This Symposium, like previous ones, supported very well Dr. John Gough's remarks when he spoke to the effect that each conference seems more fruitful than the one before. Certainly no one will deny that the topic for the Fourth Annual Lincoln Symposium was anything but timely. With education everywhere seeking new horizons, discussion of developing a more effective environment for learning is a question that is foremost in the minds of many educators.

Most participants were highly pleased with the opportunity to sit down with some of the country's most outstanding architects and communicate with them. There is little question that this communication will bear fruit. The educators, on one hand, gained an insight into what an architect thinks, does and needs to know; the architects, on the other hand, learned the same thing about the educator. Together they reached the agreement that the child is the most important person in the school.

A number of follow-up activities were suggested at the conference. One of them, proposed by Dr. Berenson, was that educators of the deaf form a resource center to pool their efforts in design of facilities as well as in developing materials. Several participants brought up the question of renovating existing facilities. This is an activity that could be carried out by the proposed resource center.

The feelings of most participants can probably be summed up in the comment of one of the visitors who wrote, "Architects have risen tremendously in my estimation after this seminar. What tremendous things can be done for the deaf when people are willing to become so involved."

APPENDIX A

SYMPOSIUM

on

RESEARCH AND UTILIZATION OF EDUCATIONAL MEDIA FOR TEACHING THE DEAF

"Designing Instructional Facilities for Teaching the Deaf: The Learning Module"

National Conference
Sponsored by the
UNIVERSITY OF NEBRASKA
DEPARTMENT OF EDUCATIONAL ADMINISTRATION
TEACHERS COLLEGE
and
MIDWEST REGIONAL MEDIA CENTER FOR THE DEAF

THE NEBRASKA CENTER FOR CONTINUING EDUCATION

Lincoln, Nebraska

February 5 - 7, 1968

Support for this conference has been provided by a grant from Captioned Films for the Deaf, Bureau of Education for the Handicapped, U.S. Office of Education, Department of Health, Education and Welfare.

PROGRAM

Monday, February 5

1:00 p.m. Registration, Conference Lobby

2:00 p.m. General Session I, Auditorium

Introductory Comments
Mr. Peter J. Owsley, Assistant Headmaster
Pennsylvania School for the Deaf

The Changing Classroom

Mr. Richard A. Clouser, Educational Consultant
Pennsylvania School for the Deaf
Philadelphia, Pennsylvania

The History of America—A Multi-media Approach

Mr. Richard W. Meisegeier
Mr. Raymond P. Stevens
Gallaudet College
Washington, D. C.

Project Design (Displays in Scottsbluff Room)

Senior Architect Students
University of Nebraska

6:30 p.m. Banquet, Omaha Room

General Session II

Chairman: Dr. Robert E. Stepp, Director
Midwest Regional Media Center for the Deaf

Welcome: Dr. Leslie L. Chisholm, Acting Chairman
Department of Educational Administration
University of Nebraska

Welcome: Dr. John A. Gough, Chief
Captioned Films for the Deaf

The Educational Implications of Architecture for the Deaf

Mr. Bertram Berenson, Professor and Director
Division of Architecture
Hampton Institute
Hampton, Virginia

and

Project Director
Physical Environment & Special Education
Council for Exceptional Children
U. S. Office of Education

Tuesday, February 6

8:45 a.m. **General Session III, Auditorium**

Introductory Comments
Dr. Stanley Roth, Superintendent
Kansas School for the Deaf

Acoustics in the Learning Module

Dr. Arthur F. Niemoeller
Research Associate
Central Institute for the Deaf
St. Louis, Missouri

Use of Amplification by Deaf School Children

Dr. Ira J. Hirsch
Director of Research
Central Institute for the Deaf
St. Louis, Missouri

Break

10:15 a.m. **Discussion Session I—Rooms and Chairmen**

Group A York Room	Mr. Dewey Brasel, Superintendent Minnesota School for the Deaf
Group B Beatrice Room	Miss Alice Kent, Supervisor East Cleveland City Schools
Group C Kearney Room	Mr. Eldon E. Shipman, Superintendent West Virginia School for the Deaf and Blind
Group D Fremont Room	Dr. Lloyd Graunke, Superintendent Tennessee School for the Deaf
Group E Hastings Room	Mrs. Dorothy Beal, Supervisor Omaha Hearing School

12:00 noon **Luncheon, Omaha Room**

General Session IV

Introductory Comments
Mr. Gilbert L. Delgado
Captioned Films for the Deaf

Furnishings in the Learning Module

Dr. Allan Leitman, Director
Early Childhood Education Study
Education Development Center
Newton, Massachusetts

1:45 p.m. General Session V, Auditorium

Introductory Comments

Dr. William J. McClure, Superintendent
Florida School for the Deaf and Blind

Lighting in the Learning Module (Via Telelecture)

Dr. H. Richard Blackwell, Director
Institute for Research in Vision
Ohio State University
Columbus, Ohio

Question and Answer Period (also via Telelecture)

Creating a Learning Environment in the Classroom

Dr. Henry W. Ray, Director
Teaching/Learning Resources
Centennial Schools
Warminster, Pennsylvania

Break

3:15 p.m. Discussion Session II, Rooms and Chairmen

Group A York Room	Miss Josephine Carr, Program Director: The Deaf, Oregon College of Education
Group B Beatrice Room	Mr. Allan J. Hayek, Assistant Superintendent North Dakota School for the Deaf
Group C Kearney Room	Mr. Paul Bird, Assistant Superintendent Idaho School for the Deaf
Group D Fremont Room	Dr. Bill G. Blevins, Assistant to the President, The Clark School for the Deaf
Group E Hastings Room	Mr. Lloyd Harrison, Superintendent Missouri School for the Deaf

6:15 p.m. Social Hour, Legion Club

7:00 p.m. Banquet, Legion Club

General Session VI
Chairman: Mr. George Propp, Area Coordinator
Midwest Regional Media Center for the Deaf

Welcome: Dean Walter K. Beggs, Teachers College
University of Nebraska

Functional Programming--Key to Architecture

Mr. George Agron, Head
Research and Programming Department
Stone, Marraccini and Patterson
San Francisco, California

Wednesday, February 7

8:30 a.m. General Session VII

Introductory Comments

Dr. Wesley C. Meierhenry, Assistant Dean
Teachers College, University of Nebraska

The New Classroom for New Learners

Dr. Donald Perrin
Associate Professor
School of Education
University of Southern California
Los Angeles, California

Break

9:15 a.m. Discussion Session III, Rooms and Chairmen

Group A York Room	Dr. David Hutcheson, Associate Professor University of Nebraska
Group B Beatrice Room	Mr. George Thompson, Superintendent Nebraska School for the Deaf
Group C Kearney Room	Mr. Kenneth Huff, Superintendent Wisconsin School for the Deaf
Group D Fremont Room	Mr. J. William Lenth, Principal Montana School for the Deaf
Group E Hastings Room	Mr. Robert J. Schmitt, Media Specialist Southwest Regional Media Center for the Deaf

11:00 a.m. General Session VIII, Auditorium

Introductory Comments
Dr. Powrie V. Doctor, Editor
American Annals of the Deaf

Conference Summary

Mr. Bertram Berenson, Professor and Director
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Hampton, Virginia

and

Project Director
Physical Environment & Special Education
Council for Exceptional Children
U. S. Office of Education

11:30 a.m. Luncheon, Omaha Room

General Session IX

Introductory Comments
Dr. Frank B. Withrow
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Bureau of Education for the Handicapped

Report from Captioned Films for the Deaf

Dr. John A. Gough, Chief
Captioned Films for the Deaf

1:30 a.m. Adjourn

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APPENDIX B

1968

Roster of Conference Participants

SYMPOSIUM ON RESEARCH AND UTILIZATION OF EDUCATIONAL MEDIA FOR TEACHING THE DEAF

"Designing Instructional Facilities for Teaching the Deaf: The Learning Module"

National Conference
Sponsored By The

University of Nebraska
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Teachers College

and

Midwest Regional Media Center for the Deaf

THE NEBRASKA CENTER FOR CONTINUING EDUCATION

Lincoln, Nebraska

February 5 - 7, 1968

Support for this conference has been provided by a grant from Captioned Films for the Deaf, Bureau of Education for the Handicapped, U. S. Office of Education, Department of Health, Education and Welfare, Washington, D. C. 20202.

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